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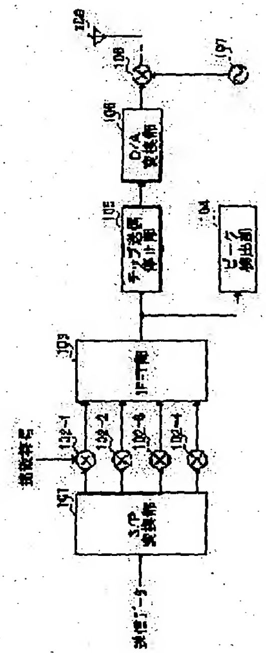
(54) MULTICARRIER CDMA COMMUNICATION SYSTEM

(57)Abstract:
PROBLEM TO BE SOLVED: To suppress the peak power of a multicarrier signal without decreasing the transmission efficiency.
SOLUTION: A serial-parallel converter section 101 converts one series of transmission data into a plurality of series of transmission data. Diffusing sections 102-1 to 102-4 perform a diffusion process on the first to fourth series of transmission data, respectively. An IFFT section 103 overlays the first to fourth series of transmission data after subjected to the diffusion process on first to fourth subcarriers to generate multicarrier signals. A peak detecting section 104 detects the peak power of the multicarrier signals. Using the detected result of the peak detecting section 104, a chip transmission stop section 105 outputs those multicarrier signals whose peak power is found to be a threshold value or above, into a D/A converter section 106.



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CLAIMS

[Claim(s)]

[Claim 1] The multi-carrier CDMA communication device characterized by providing the following. A conversion means to change the information signal of one sequence into the information signal to which diffusion process of two or more sequences was carried out. A generation means to superimpose each of the information signal to which diffusion process of the aforementioned two or more sequences was carried out to a subcarrier peculiar to a sequence, and to generate a multi-carrier signal. A peak-power detection means to detect the peak power of the aforementioned multi-carrier signal. A transmitting means to transmit only the multi-carrier signal whose aforementioned peak power is below a threshold.

[Claim 2] The multi-carrier CDMA communication device characterized by providing the following. A conversion means to change the information signal of one sequence into the information signal to which diffusion process of two or more sequences was carried out. A generation means to superimpose each of the information signal to which diffusion process of the aforementioned two or more sequences was carried out to a subcarrier peculiar to a sequence, and to generate a multi-carrier signal. A peak-power detection means to detect the peak power of the aforementioned multi-carrier signal. The regeneration means which carries out regeneration of the multi-carrier signal at the time of superimposing the signal for replacing with an information signal to at least one specific subcarrier in the aforementioned subcarrier, and oppressing a peak power when the aforementioned peak power exceeds a threshold, and the aforementioned peak power exceeding a threshold.

[Claim 3] A generation means is a multi-carrier CDMA communication device according to claim 2 characterized by superimposing the information signal to which error correcting code-ized processing was performed to a specific subcarrier before diffusion process among the information signals to which diffusion process of two or more sequences was carried out.

[Claim 4] A regeneration means is a multi-carrier CDMA communication device according to claim 2 or 3 characterized by using a random signal as a signal for oppressing a peak power.

[Claim 5] A regeneration means is a multi-carrier CDMA communication device according to claim 2 or 3 characterized by an amplitude using the signal of abbreviation 0 as a signal for oppressing a peak power.

[Claim 6] A multi-carrier CDMA communication device given in either of a claim 2 to the claims 5 characterized by providing a clipping means by which a peak power performs clipping processing to the multi-carrier signal exceeding a threshold among generation or the multi-carrier signal by which regeneration was carried out.

[Claim 7] a multi-carrier CDMA communication device given in either of a claim 2 to the claims 6 characterized by a conversion means possessing a sequence conversion means to change the information signal of one sequence into the information signal of two or more sequences, and a diffusion means for the information signal of the aforementioned two or more sequences to be alike, respectively, to receive, and to perform diffusion process

[Claim 8] A conversion means is a multi-carrier CDMA communication device given in either of the claim 2 characterized by providing a diffusion means to perform diffusion process to the information signal of one sequence, and a sequence conversion means to change into the information signal of two or more sequences the information signal of one sequence by which diffusion process was carried out, and a claim 4 to the claims 6.

[Claim 9] The communication terminal characterized by equipping either of a claim 1 to the claims 8 with the multi-carrier CDMA communication device of a publication.

[Claim 10] Base station equipment characterized by equipping either of a claim 1 to the claims 8 with the multi-carrier CDMA communication device of a publication.

[Claim 11] The multi-carrier CDMA correspondence procedure characterized by providing the following. The conversion process which changes the information signal of one sequence into the information signal to which diffusion process of two or more sequences was carried out. The generation process which superimposes each of the information signal to which diffusion process of the aforementioned two or more sequences was carried out to a subcarrier peculiar to a sequence, and generates a multi-carrier signal. The peak-power detection process of detecting the peak power of the aforementioned multi-carrier signal. The transmitting process which transmits only the multi-carrier signal whose aforementioned peak power is below a threshold.

[Claim 12] The multi-carrier CDMA correspondence procedure characterized by providing the following. The conversion process which changes the information signal of one sequence into the information signal to which diffusion process of two or more sequences was carried out. The generation process which superimposes each of the information signal to which diffusion process of the aforementioned two or more sequences was carried out to a subcarrier peculiar to a sequence, and generates a multi-carrier signal. The peak-power detection process of detecting the peak power of the aforementioned multi-carrier signal. The regeneration process which carries out regeneration of the multi-carrier signal at the time of superimposing the signal for replacing with an information signal to at least one specific subcarrier in the aforementioned subcarrier, and oppressing a peak power when the aforementioned peak power exceeds a threshold, and the aforementioned peak power exceeding a threshold.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] Especially this invention relates to the multi-carrier CDMA communication device which combined the multi-carrier transmission system and the CDMA transmission system about the communication device of a multi-carrier transmission system.
[0002]
[Description of the Prior Art] Recently, communication of the multi-carrier CDMA method which combined the multi-carrier transmission system and the CDMA transmission system attracts attention, and is considered briskly. Generally this multi-carrier CDMA method is classified into a "MC/DS-CDMA method" and a "MC-CDMA method." Hereafter, the communication device which adopted the above-mentioned all directions formula is explained.
[0003] First, the communication device (only henceforth a "MC/DS-CDMA communication device") which adopted MC / DS-CDMA method is explained with reference to drawing 17 - drawing 20 . Drawing 17 is the block diagram showing the composition of the conventional MC/DS-CDMA communication device. Drawing 18 is the ** type view showing notionally the transmit data inputted into the conventional MC/DS-CDMA communication device. Drawing 19 is the ** type view showing notionally the transmit data of two or more sequences in the conventional MC/DS-CDMA communication device. Drawing 20 is the ** type view showing notionally the transmit data of two or more sequences after the diffusion process in the conventional MC / DS-CDMA communication device.
[0004] In drawing 17 , the transmit data (for example, transmit data [for N symbol]; refer to drawing 18) of one sequence is changed into the transmit data of two or more sequences by the serial-parallel (henceforth "S/P") transducer 11. The number of sequences here is equivalent to the total number of subcarriers (N). In addition, the transmit data of the 1st sequence - the Nth sequence is called, applying the transmit data of two or more sequences shown in drawing 17 for convenience of explanation to the lower part from the upper part. Here, the transmit data of the 1st symbol - the Nth symbol turns into transmit data of the 1st sequence - the Nth sequence, respectively.
[0005] In the diffusion section 12-1 - diffusion section 12-N, diffusion process of the transmit data of the 1st sequence - the Nth sequence is carried out with the diffusion sign of a diffusion coefficient M, respectively. Thereby, the transmit data of the 1st sequence - the Nth sequence serves as a signal of the chip unit which the frequency band diffused M times, as shown in drawing 20 . For example, by diffusion process, it serves as a signal of the chip unit which has the 1st chip 21-1 - Mth chip 21-M while the frequency band diffuses the transmit data of the 1st sequence M times.
[0006] In the reverse fast-Fourier-transform (it is called "IFFT" below Inverse Fast Fourier Transform;.) section 13, IFFT processing (namely, Frequency-Division-Multiplexing processing) using the transmit data of the 1st sequence after diffusion process - the Nth sequence is performed. The multi-carrier signal with which the 1st subcarrier - the Nth subcarrier were overlapped on the transmit data of the 1st sequence after diffusion process - the Nth sequence, respectively is generated by this Frequency-Division-Multiplexing processing.
[0007] Next, the communication device (only henceforth a "MC-CDMA communication device") which adopted the MC-CDMA method is explained with reference to drawing 21 - drawing 23 . Drawing 21 is the block diagram showing the composition of the conventional MC-CDMA communication device. Drawing 22 is the ** type view showing notionally the transmit data of one sequence after the diffusion process in the conventional MC-CDMA communication device. Drawing 23 is the ** type view showing notionally the transmit data of two or more sequences in the conventional MC-CDMA communication device.
[0008] In drawing 21 , diffusion process of the transmit data (for example, transmit data [for N symbol]; refer to drawing 18) of one sequence is carried out by the diffusion section 31 with the diffusion sign of a diffusion coefficient M. Thereby, the transmit data of one sequence becomes the signal (the [the 1st chip 41-1 -] MxN chip 4 N-M) of the

chip unit which the frequency band diffused M times, as shown in drawing 22 . For example, it is made into the signal of the chip unit which has the 1st chip 41-1 - Mth chip 41-M while the frequency band diffuses the transmit data of the 1st symbol M times.

[0009] The transmit data of one sequence after diffusion process is changed into the transmit data of two or more sequences by the S/P transducer 32. The number of sequences here is equivalent to the total number (MxN) of subcarriers. in addition, the transmit data of two or more sequences of explanation shown in drawing 21 for convenience -- the lower part from the upper part -- applying -- the [the 1st sequence -] -- the transmit data of an MxN sequence is called here -- the [the 1st chip 41-1 -] -- MxN chip 4 N-M is shown in drawing 23 -- as -- respectively -- the [the 1st sequence -] -- it becomes the transmit data of an MxN sequence

[0010] the IFFT section 33 -- setting -- the [the 1st sequence -] -- IFFT processing using the transmit data of an MxN sequence is performed this IFFT processing -- the [the 1st sequence -] -- the transmit data of an MxN sequence -- respectively -- the [the 1st subcarrier -] -- the multi-carrier signal on which the MxN subcarrier was overlapped is generated

[0011]

[Problem(s) to be Solved by the Invention] However, there are the following problems in communication of the above-mentioned conventional multi-carrier CDMA method. That is, in a multi-carrier transmission system, there is a fault that the peak power to the mean power of a multi-carrier signal becomes large in proportion to the number of subcarriers. For this reason, since the influence of the nonlinear distortion in the power amplification section becomes large, the spectrum radiation through which it passes out of band will increase. Such a problem may arise similarly in the multi-carrier CDMA method which combined the multi-carrier transmission system and the CDMA transmission system.

[0012] In order to solve such a problem, at the time when the peak power exceeding a certain threshold appears By generating a compensatory signal which serves as a multi-carrier signal and an opposite phase, arranging this signal to the specific subcarrier (subcarrier in which the subcarrier for transmitting an information signal was prepared independently) called compensation carrier, and generating a multi-carrier signal The method of oppressing the peak power of a multi-carrier signal is proposed in multi-carrier transmission (Shingaku Giho RCS 99-144 (1999-11) "the peak-power suppression method using the parity carrier in multi-carrier transmission"). This method is applicable also to a multi-carrier CDMA method.

[0013] However, although it becomes possible to oppress the peak power of a multi-carrier signal by arranging a compensatory signal on a compensation carrier when such a method is applied, the total of the subcarrier for only the part of this compensation carrier transmitting an information signal decreases. That is, although a compensation carrier is a subcarrier which contributes to suppression of a peak power, it can be said to an information transmission as the subcarrier which does not contribute. Consequently, in the above-mentioned conventional multi-carrier CDMA transmission, the problem that a transmission efficiency falls newly occurs.

[0014] It aims at offering the multi-carrier CDMA communication device which oppresses the peak power of a multi-carrier signal, this invention being made in view of this point, and suppressing decline in a transmission efficiency.

[0015]

[Means for Solving the Problem] The multi-carrier CDMA communication device of this invention takes the composition possessing a conversion means change the information signal of one sequence into the information signal to which diffusion process of two or more sequences was carried out, a generation means superimposes each of the information signal to which diffusion process of the aforementioned two or more sequences was carried out to a subcarrier peculiar to a sequence, and generate a multi-carrier signal, a peak-power detection means detect the peak power of the aforementioned multi-carrier signal, and a transmitting means transmit only the multi-carrier signal whose aforementioned peak power is below a threshold.

[0016] The multi-carrier signal is generated by superimposing the information signal which carried out diffusion process to this subcarrier after preparing all the subcarriers as a subcarrier for transmitting an information signal according to this composition. Thereby, decline in a transmission efficiency is suppressed. Furthermore, since it does not transmit about the multi-carrier signal with which a peak power exceeds a threshold while transmitting as it is about the multi-carrier signal whose peak power is below a threshold, the influence of the nonlinear distortion in power amplifier can be suppressed.

[0017] The multi-carrier CDMA communication device of this invention A conversion means to change the information signal of one sequence into the information signal to which diffusion process of two or more sequences was carried out, A generation means to superimpose each of the information signal to which diffusion process of the aforementioned two or more sequences was carried out to a subcarrier peculiar to a sequence, and to generate a multi-carrier signal, A peak-power detection means to detect the peak power of the aforementioned multi-carrier signal, and when the aforementioned peak power exceeds a threshold The signal for replacing with an information signal to at least one specific subcarrier in the aforementioned subcarrier, and oppressing a peak power is superimposed, and the composition possessing the regeneration means which carries out regeneration of the multi-carrier signal at the time of the aforementioned peak power exceeding a threshold is taken.

[0018] The multi-carrier signal of a chip unit is generated by superimposing the information signal which carried out diffusion process to this subcarrier after preparing all the subcarriers as a subcarrier for transmitting an information signal according to this composition. Thereby, decline in a transmission efficiency is suppressed. Furthermore, when the peak power which exceeds a threshold to a multi-carrier signal occurs, the signal for oppressing a peak power to at least one subcarrier is superimposed, and regeneration of the multi-carrier signal is carried out. The peak power of the multi-carrier signal by which regeneration is carried out can be stopped by decreasing by this the number of the information signals superimposed to a subcarrier. Therefore, the influence of the nonlinear distortion in power amplifier can be suppressed.

[0019] The multi-carrier CDMA communication device of this invention takes the composition whose generation means superimposes the information signal to which error correcting code-ized processing was performed to a specific subcarrier before diffusion process among the information signals to which diffusion process of two or more sequences was carried out.

[0020] According to this composition, a receiving set can reproduce transmit data correctly by performing error correction decryption processing to this signal, even if it cannot decode appropriately the signal transmitted by the subcarrier superimposed on the signal for oppressing a peak power.

[0021] The multi-carrier CDMA communication device of this invention takes the composition using a signal with a regeneration means random as a signal for oppressing a peak power.

[0022] The multi-carrier CDMA communication device of this invention takes composition of an amplitude using the signal of abbreviation 0 as a signal for a regeneration means oppressing a peak power.

[0023] According to these composition, the peak power of the multi-carrier signal by which regeneration was carried out can be stopped certainly.

[0024] The multi-carrier CDMA communication device of this invention takes the composition possessing a clipping means to perform clipping processing, to the multi-carrier signal with which a peak power exceeds a threshold among generation or the multi-carrier signal by which regeneration was carried out.

[0025] The peak power in a multi-carrier signal can be oppressed certainly, shortening the processing time by performing clipping processing to the generated multi-carrier signal or the multi-carrier signal by which regeneration was carried out according to this composition.

[0026] the multi-carrier CDMA communication device of this invention takes the composition in which a conversion means possesses a sequence conversion means to change the information signal of one sequence into the information signal of two or more sequences, and a diffusion means for the information signal of the aforementioned two or more sequences to be alike, respectively, to receive, and to perform diffusion process

[0027] According to this composition, the peak power of a multi-carrier signal can be oppressed in MC / DS-CDMA method, suppressing decline in a transmission efficiency.

[0028] The multi-carrier CDMA communication device of this invention takes the composition in which a conversion means possesses a diffusion means to perform diffusion process to the information signal of one sequence, and a sequence conversion means to change into the information signal of two or more sequences the information signal of one sequence to which diffusion process was carried out.

[0029] According to this composition, the peak power of a multi-carrier signal can be oppressed in a MC-CDMA method, suppressing decline in a transmission efficiency.

[0030] The communication terminal of this invention equips one of the above with the multi-carrier CDMA communication device of a publication, and takes composition for **.

[0031] The base station equipment of this invention takes the composition equipped with the multi-carrier CDMA communication device of one of the above.

[0032] According to these composition, good communication can be performed by having the multi-carrier CDMA communication device which oppresses the peak power of a multi-carrier signal, suppressing decline in a transmission efficiency.

[0033] The multi-carrier CDMA correspondence procedure of this invention possesses the conversion process which changes the information signal of one sequence into the information signal to which diffusion process of two or more sequences was carried out, the generation process which superimpose each of the information signal to which diffusion process of the aforementioned two or more sequences was carried out to a subcarrier peculiar to a sequence, and generates a multi-carrier signal, the peak-power detection process of detecting the peak power of the aforementioned multi-carrier signal, and the transmitting process which transmit only the multi-carrier signal whose aforementioned peak power is below a threshold.

[0034] The multi-carrier signal is generated by superimposing the information signal which carried out diffusion process to this subcarrier after preparing all the subcarriers as a subcarrier for transmitting an information signal according to this method. Thereby, decline in a transmission efficiency is suppressed. Furthermore, since it does not transmit about the multi-carrier signal with which a peak power exceeds a threshold while transmitting as it is about the multi-carrier signal whose peak power is below a threshold, the influence of the nonlinear distortion in power amplifier can be suppressed.

[0035] The multi-carrier CDMA correspondence procedure of this invention The conversion process which changes the information signal of one sequence into the information signal to which diffusion process of two or more sequences was carried out, The generation process which superimposes each of the information signal to which diffusion process of the aforementioned two or more sequences was carried out to a subcarrier peculiar to a sequence, and generates a multi-carrier signal, The peak-power detection process of detecting the peak power of the aforementioned multi-carrier signal, and when the aforementioned peak power exceeds a threshold The signal for replacing with an information signal to at least one specific subcarrier in the aforementioned subcarrier, and oppressing a peak power is superimposed, and the regeneration process which carries out regeneration of the multi-carrier signal at the time of the aforementioned peak power exceeding a threshold is provided.

[0036] The multi-carrier signal of a chip unit is generated by superimposing the information signal which carried out diffusion process to this subcarrier after preparing all the subcarriers as a subcarrier for transmitting an information signal according to this method. Thereby, decline in a transmission efficiency is suppressed. Furthermore, when the peak power which exceeds a threshold to a multi-carrier signal occurs, the signal for oppressing a peak power to at least one subcarrier is superimposed, and regeneration of the multi-carrier signal is carried out. The peak power of the multi-carrier signal by which regeneration is carried out can be stopped by decreasing by this the number of the information signals superimposed to a subcarrier. Therefore, the influence of the nonlinear distortion in power amplifier can be suppressed.

[0037]

[Embodiments of the Invention] The main point of this invention is carrying out regeneration of the multi-carrier signal at the time of superimposing the signal for not transmitting this multi-carrier signal or oppressing a peak power to at least one subcarrier among all subcarriers, and a peak power exceeding a threshold, when the peak power which superimposes an information signal to all subcarriers, generates a multi-carrier signal, and exceeds a threshold to the generated multi-carrier signal occurs.

[0038] Hereafter, the gestalt of operation of this invention is explained in detail with reference to a drawing.

[0039] (Gestalt 1 of operation) The gestalt of this operation explains the case where transmission of the multi-carrier signal with which a peak power exceeds a threshold is stopped, in a MC/DS-CDMA method. Drawing 1 is the block diagram showing the composition of the sending set equipped with the multi-carrier CDMA communication device concerning the gestalt 1 of operation of this invention.

[0040] In drawing 1 , the S/P transducer 101 changes the transmit data of one sequence into the transmit data of two or more sequences. The diffusion section 102-1 - the diffusion section 102-4 perform diffusion process to the transmit data from the S/P transducer 101, respectively. The IFFT section 103 generates a multi-carrier signal per chip by performing IFFT processing (Frequency-Division-Multiplexing processing) which used the transmit data of two or more sequences after diffusion process.

[0041] The peak-detection section 104 detects per chip whether the peak power which exceeds a threshold to the generated multi-carrier signal has occurred, and sends a detection result to the chip transmitting halt section 105. The chip transmitting halt section 105 controls the output to the D/A-conversion section 106 of the generated multi-carrier signal based on the detection result from the peak-detection section 104.

[0042] The D/A-conversion section 106 changes the multi-carrier signal from the chip transmitting halt section 105 into an analog signal. The multiplication section 108 performs modulation processing to the multi-carrier signal changed into the analog signal by carrying out the multiplication of the multi-carrier signal and the local signal from VCO 107 which were changed into the analog signal. The multi-carrier signal after modulation processing is transmitted to a communications partner through an antenna 109.

[0043] Drawing 2 is the block diagram showing the composition of the receiving set equipped with the multi-carrier CDMA communication device concerning the gestalt 1 of operation of this invention. The signal transmitted by the communications partner is received by the antenna 201 in drawing 2 . In addition, the above-mentioned communications partner possesses the sending set shown in drawing 1 .

[0044] The multiplication section 203 generates a recovery signal by carrying out the multiplication of the signal (input

signal) and the local signal from VCO 202 which were received by the antenna 201. The A/D-conversion section 204 changes the generated recovery signal into a digital signal.
[0045] To the recovery signal changed into the digital signal, the FFT section 205 performs fast-Fourier-transform (it is called "FFT" below Fast Fourier Transform;.) processing, and extracts the signal transmitted by each subcarrier.
[0046] The back-diffusion-of-gas section 206-1 - the back-diffusion-of-gas section 206-4 perform back-diffusion-of-gas processing to the signal transmitted by each subcarrier. The parallel-serial (henceforth "P/S") transducer 207 changes the signal after the back-diffusion-of-gas processing from the back-diffusion-of-gas section 206-1 - the back-diffusion-of-gas section 206-4 into the decode data of one sequence.
[0047] Subsequently, operation of the sending set and a receiving set equipped with the multi-carrier CDMA communication device concerning the gestalt of this operation is explained. First, in addition to drawing 1 , operation of the above-mentioned sending set is explained with reference to drawing 3 - drawing 5 .
[0048] Drawing 3 is the ** type view showing notionally an example of the transmit data inputted into the sending set equipped with the multi-carrier CDMA communication device concerning the gestalt 1 of operation of this invention. Drawing 4 is the ** type view showing notionally an example of the transmit data of two or more sequences in the sending set equipped with the multi-carrier CDMA communication device concerning the gestalt 1 of operation of this invention. Drawing 5 is the ** type view showing notionally an example of the transmit data of two or more sequences after the diffusion process in the sending set equipped with the multi-carrier CDMA communication device concerning the gestalt 1 of operation of this invention.
[0049] In drawing 1 , the transmit data (transmit data [for four symbols]; here, refer to drawing 3 as an example) of one sequence is changed into the transmit data of two or more sequences by the S/P transducer 101. The number of sequences here is equivalent to the total number of subcarriers (referred to as 4 as an example). In addition, it considers as the transmit data of the 1st sequence - the 4th sequence, applying the transmit data of two or more sequences shown in drawing 1 for convenience of explanation to the lower part from the upper part. Here, the transmit data of a symbol 301 - a symbol 304 turns into transmit data of the 1st sequence - the 4th sequence, respectively, as shown in drawing 4 .
[0050] Diffusion process of the transmit data of the 1st sequence - the 4th sequence is carried out by the diffusion section 102-1 - the diffusion section 102-4, respectively. In addition, in each diffusion section, in order to simplify explanation, the diffusion sign of a diffusion coefficient 5 shall be used as an example. By this diffusion process, the transmit data of the 1st sequence - the 4th sequence serves as a signal of the chip unit which the frequency band diffused 5 times, as shown in drawing 5 . For example, by diffusion process, it serves as a signal of the chip unit which has a chip 501-1 - a chip 501-5 while the frequency band diffuses the transmit data of the 1st sequence 5 times.
[0051] In the IFFT section 103, IFFT processing (namely, Frequency-Division-Multiplexing processing) using the transmit data (information signal) of the 1st sequence after diffusion process - the 4th sequence is performed. The multi-carrier signal with which the 1st subcarrier - the 4th subcarrier were overlapped on the transmit data of the 1st sequence after diffusion process - the 4th sequence, respectively is generated per chip by this Frequency-Division-Multiplexing processing. For example, in time T3, the multi-carrier signal with which the 1st subcarrier - the 4th subcarrier were overlapped on the chip 501-3 in the transmit data of the 1st sequence, the chip 502-3 in the transmit data of the 2nd sequence, the chip 503-3 in the transmit data of the 3rd sequence, and the chip 504-3 in the transmit data of the 4th sequence, respectively is generated (refer to drawing 5). The multi-carrier signal of the generated chip unit is sent to the peak-detection section 104 and the chip transmitting halt section 105.
[0052] In the peak-detection section 104, it is detected whether the peak power to which the power of the multi-carrier signal from the IFFT section 103 is measured per chip, and exceeds a threshold to the multi-carrier signal in each chip has occurred. A detection result is sent to the chip transmitting halt section 105.
[0053] In the chip transmitting halt section 105, the output to the D/A-conversion section 106 of the generated multi-carrier signal is performed per chip based on the detection result from the peak-detection section 104. That is, the multi-carrier signal in the chip with which the peak power exceeding a threshold is not detected is sent to the D/A-conversion section 106, and the multi-carrier signal in the chip with which the peak power exceeding a threshold was detected conversely is canceled, without being sent to the D/A-conversion section 106. Consequently, it replaces with the multi-carrier signal in the chip with which the peak power exceeding a threshold was detected, and the signal of abbreviation 0 is outputted for an amplitude to the D/A-conversion section 106.
[0054] For example, its attention is paid to the multi-carrier signal (multi-carrier signal in the 3rd chip) generated at time T3 with reference to drawing 5 . The multi-carrier signal generated at time T3 is a signal generated when the 1st subcarrier - the 4th subcarrier were overlapped on the chip 501-3 in the transmit data of the 1st sequence, the chip 502-3 in the transmit data of the 2nd sequence, the chip 503-3 in the transmit data of the 3rd sequence, and the chip 504-3 in the transmit data of the 4th sequence, respectively. When it is detected by the peak-detection section 104 that the

peak power which exceeds a threshold to the multi-carrier signal in this 3rd chip arose, this multi-carrier signal is canceled without being outputted to the D/A-conversion section 106 by the chip transmitting halt section 105.
[0055] In this case, the symbol 301 of the 1st subcarrier - the 4th subcarrier which is alike, respectively and is transmitted more - a symbol 304 become what lacked one chip (respectively information about a chip 501-3 - a chip 504-3).
[0056] After the multi-carrier signal from the chip transmitting halt section 105 is changed into an analog signal in the D/A-conversion section 106, modulation processing is performed by carrying out multiplication to the local signal from VCO 107 in the multiplication section 108. The multi-carrier signal after modulation processing is transmitted to a communications partner through an antenna 109.
[0057] Next, operation of the above-mentioned receiving set is explained with reference to drawing 2 . In drawing 2 , the signal transmitted by the above-mentioned sending set is received by the antenna 201. A recovery signal is generated by carrying out the multiplication of the signal (input signal) received by the antenna 201 to the local signal from VCO 202 in the multiplication section 203. The generated recovery signal is changed into a digital signal by making A/D-conversion processing in the A/D-conversion section 204.
[0058] By carrying out FFT processing of the recovery signal changed into the digital signal in the FFT section 205, each signal transmitted by the 1st subcarrier - the 4th subcarrier is extracted. That is, the 1st recovery signal - 4th recovery signal is extracted by the FFT section 205.
[0059] As for the 1st recovery signal extracted by the FFT section 205 - the 4th recovery signal, in the back-diffusion-of-gas section 206-1 - the back-diffusion-of-gas section 206-4, the back symbol judging by which back-diffusion-of-gas processing was made is made, respectively. In addition, the diffusion sign used for the back-diffusion-of-gas section 206-1 - the back-diffusion-of-gas section 206-4 cannot be overemphasized by that it is the same as that of the diffusion sign used for the diffusion section 102-1 in drawing 1 - the diffusion section 102-4, respectively.
[0060] Here, the sending set mentioned above may originate in not transmitting the multi-carrier signal in the chip which produced the peak power exceeding a threshold, and the 1st recovery signal extracted by the FFT section 205 - the 4th recovery signal may turn into a signal with which the chip concerned was missing. For example, since a chip 501-3 to 504-3 is not transmitted when the peak power which exceeds a threshold to the multi-carrier signal generated at time T3 in a sending set is detected with reference to drawing 5 , in a receiving set, the 1st recovery signal - 4th recovery signal turns into a signal with which the chip 501-3 to 504-3 was missing, respectively.
[0061] However, it can be said that it is decomposed into two or more chips by diffusion process, and each symbol is transmitted with reference to drawing 3 and drawing 5 . For example, it is decomposed into five chips of a chip 501-1 to 505-5 by diffusion process, and the symbol 301 is transmitted.
[0062] Therefore, even if the 1st recovery signal - 4th recovery signal is a signal lacking in a part of chips, in the back-diffusion-of-gas section 206-1 - the back-diffusion-of-gas section 206-4, a suitable symbol judging can be performed using the 1st recovery signal by which back-diffusion-of-gas processing was carried out - the 4th recovery signal, respectively. Even when the multi-carrier signal generated at time T3 is not transmitted specifically with reference to drawing 3 and drawing 5 , as for a symbol 301, based on the signal with which back-diffusion of gas of a chip 501-1, a chip 501-2, a chip 501-4, and the chip 501-5 was carried out, a symbol judging is made appropriately, for example. The signal in which the symbol judging was carried out by the back-diffusion-of-gas section 206-1 - the back-diffusion-of-gas section 206-4 is changed into the decode data of one sequence by the P/S transducer 207.
[0063] Thus, the multi-carrier signal of a chip unit is generated by superimposing the information signal which carried out diffusion process to this subcarrier after preparing all the subcarriers as a subcarrier for transmitting an information signal rather than preparing the subcarrier which transmits first only the compensatory signal which oppresses a peak power fixed in the form of this operation, and the subcarrier which transmits only an information signal. Thereby, decline in a transmission efficiency is suppressed.
[0064] Furthermore, since it does not transmit about the multi-carrier signal with which a peak power exceeds a threshold while transmitting as it is about the multi-carrier signal whose peak power is below a threshold, the influence of the nonlinear distortion in power amplifier can be suppressed.
[0065] Moreover, each symbol is decomposed and transmitted to two or more chips by making diffusion process. A symbol judging is appropriately carried out by back-diffusion-of-gas processing, and each symbol is reproduced [in / a receiving set / as a part of chips included in each symbol not being transmitted by this (it having been missing)]. As mentioned above, according to the form of this operation, the peak power of a multi-carrier signal can be oppressed, suppressing decline in a transmission efficiency.
[0066] (Form 2 of operation) The case where transmission by at least one subcarrier is stopped by the form of this operation among all subcarriers in the form 1 of operation about the multi-carrier signal with which a peak power exceeds a threshold is explained. Drawing 6 is the block diagram showing the composition of the sending set equipped

with the multi-carrier CDMA communication device concerning the form 2 of operation of this invention.

[0067] In drawing 6 , the selection section 601 outputs at least one transmit data to the IFFT section 602 in response to control by the transmitting halt carrier determination section 604 mentioned later among the transmit data of the 1st sequence after the diffusion process from the diffusion section 102-1 to 102-4 - the 4th sequence.

[0068] The IFFT section 602 generates a multi-carrier signal per chip by performing IFFT processing using the transmit data after diffusion process in response to control by the peak-detection section 603 mentioned later. Furthermore, the IFFT section 602 outputs only the multi-carrier signal in the chip which the peak power exceeding a threshold has not generated to D/A conversion 106 in response to control by the peak-detection section 603.

[0069] The peak-detection section 603 detects per chip whether the peak power which exceeds a threshold to the generated multi-carrier signal has occurred, and outputs a detection result to the transmitting halt carrier determination section 604. Moreover, the peak-detection section 603 controls the IFFT section 602 to perform regeneration of the multi-carrier signal in the chip which generated the peak power exceeding a threshold.

[0070] The transmitting halt carrier determination section 604 determines the transmit data which the selection section 601 should output to the IFFT section 602 among the transmit data of the 1st sequence - the 4th sequence according to the detection result from the peak-detection section 603. Furthermore, the transmitting halt carrier determination section 604 controls the selection section 601 to output the determined transmit data to the IFFT section 602. In addition, about the composition of the sending set shown in drawing 6 , and the receiving set which performs radio, since it is the same as that of the receiving set (drawing 2) in the form 1 of operation, detailed explanation is omitted.

[0071] Subsequently, operation of the sending set and a receiving set equipped with the multi-carrier CDMA communication device concerning the form of this operation is explained. In addition, detailed explanation is omitted about the same operation as the form 1 of the operation in the form of this operation.

[0072] In drawing 6 , after diffusion process of the transmit data of the 1st sequence - the 4th sequence is carried out by the diffusion section 102-1 to 102-4, it is outputted to the selection section 601, respectively. As the selection section 601 usually outputs the transmit data of the 1st sequence - the 4th sequence to the IFFT section 602, the transmit data of the 1st sequence by which diffusion process was therefore carried out from the selection section 601 to the IFFT section 602 - the 4th sequence controlled by the transmitting halt carrier determination section 604 is outputted to the IFFT section 602.

[0073] In the IFFT section 602, IFFT processing which used the transmit data of the 1st sequence after diffusion process - the 4th sequence is performed. The multi-carrier signal with which the 1st subcarrier - the 4th subcarrier were overlapped on the transmit data of the 1st sequence after diffusion process - the 4th sequence, respectively is generated by this IFFT processing. The multi-carrier signal of the generated chip unit is outputted to the peak-detection section 603.

[0074] In the peak-detection section 603, it is detected whether the peak power to which the power of the multi-carrier signal from the IFFT section 602 is measured per chip, and exceeds a threshold to the multi-carrier signal in each chip has occurred.

[0075] When the peak power which exceeds a threshold to the multi-carrier signal in a certain chip has not occurred, the control signal of the purport which outputs the multi-carrier signal in this chip to the D/A-conversion section 106 is outputted from the peak-detection section 603 to the IFFT section 602. Consequently, the multi-carrier signal in the chip whose peak power is below a threshold is outputted from the IFFT section 602 to the D/A-conversion section 106.

[0076] On the contrary, when the peak power which exceeds a threshold to the multi-carrier signal in a certain chip has occurred, while the control signal of the purport which performs regeneration of the multi-carrier signal in this chip is outputted from the peak-detection section 603 to the IFFT section 602, the purport which the peak power exceeding a threshold generated is outputted to the multi-carrier signal in this chip from the peak-detection section 603 to the transmitting halt carrier determination section 604.

[0077] In the transmitting halt carrier determination section 604, the transmit data which should be outputted to the IFFT section 602 among the transmit data of the 1st sequence - the 4th sequence is determined. You may make it choose at random out of the transmit data of the 1st sequence - the 4th sequence as transmit data which should be outputted to the IFFT section 602, and may make it choose the transmit data beforehand set up out of the transmit data of the 1st sequence - the 4th sequence.

[0078] In order to make better the property of the input signal in a receiving set, with the gestalt of this operation at the time of the 1st regeneration Three transmit data (for example, transmit data of the 1st sequence - the 3rd sequence) are chosen among the transmit data of the 1st sequence - the 4th sequence. at the time of the regeneration of the 2nd henceforth According to a different combination from the time of the 1st regeneration among the transmit data of the 1st sequence - the 4th sequence, three transmit data (for example, transmit data of the 1st sequence, the 2nd sequence, and the 4th sequence) are chosen.

[0079] When the peak power which exceeds a threshold to a multi-carrier signal with any combination occurs, two transmit data are chosen among the transmit data of the 1st sequence - the 4th sequence. The transmit data which should be outputted to the IFFT section 602 similarly hereafter is determined. Consequently, at the time of the regeneration of a multi-carrier signal, the transmit data of at least 1 sequence will be outputted from the selection section 601 among the transmit data of the 1st sequence - the 4th sequence to the IFFT section 602.

[0080] Then, the control signal of the purport which outputs the transmit data of the sequence determined from the transmitting halt carrier determination section 604 to the selection section 601 to the IFFT section 602 is outputted. Consequently, the transmit data of at least one sequence determined by the transmitting halt carrier determination section 604 among the transmit data of the 1st sequence after diffusion process - the 4th sequence is outputted to the IFFT section 602.

[0081] In the IFFT section 602, regeneration of the multi-carrier signal in the chip which generated the peak power exceeding a threshold is performed. for example, when the peak power which exceeds a threshold to the multi-carrier signal in the chip corresponding to time T3 had occurred by the peak-detection section 603 with reference to drawing 5 and it is detected the chip [in / the transmit data of the 1st sequence / at the IFFT section 602] 501-3, and the chip 502-3 in the transmit data of the 2nd sequence -- and Regeneration of the multi-carrier signal with which the 1st subcarrier - the 3rd subcarrier were overlapped on the chip 503-3 in the transmit data of the 3rd sequence, respectively is carried out. At the time of this regeneration, the 4th subcarrier is not overlapped on the chip 504-3 in the transmit data of the 4th sequence. If it puts in another way, the 4th subcarrier is overlapped in an amplitude on the signal of abbreviation 0.

[0082] As the multi-carrier signal in which regeneration was carried out by the IFFT section 602 was mentioned above in the peak-detection section 603, detection of whether a peak power which exceeds a threshold has occurred is made.

[0083] to which the multi-carrier signal in this chip by which regeneration was carried out from the IFFT section 602 to the D/A-conversion section 106 is outputted when the peak power to which processing which was mentioned above is made and exceeds a threshold in the peak-detection section 603 to the multi-carrier signal in a certain chip by which regeneration was carried out has not occurred On the contrary, when the peak power which exceeds a threshold to the multi-carrier signal in a certain chip by which regeneration was carried out has still occurred, after being changed according to the method which the transmit data which should be outputted to the IFFT section 602 mentioned above in the transmitting halt carrier determination section 604, in the IFFT section 602, regeneration of the multi-carrier signal in this chip is performed. Henceforth, operation which was mentioned above is repeated until the peak power which exceeds a threshold to the multi-carrier signal in this chip stops occurring..

[0084] About operation of the receiving set equipped with the multi-carrier CDMA communication device concerning the gestalt of this operation, since it is the same as that of operation of the receiving set equipped with the multi-carrier CDMA communication device concerning the gestalt 1 of operation, detailed explanation is omitted except for the back-diffusion-of-gas section 206-1 to 206-4.

[0085] As the gestalt 1 of operation explained, as for the 1st recovery signal extracted by the FFT section 205 - the 4th recovery signal, in the back-diffusion-of-gas section 206-1 - the back-diffusion-of-gas section 206-4, the back symbol judging by which back-diffusion-of-gas processing was made is made, respectively.

[0086] Here, when the peak power which exceeds a threshold for a chip with the generated multi-carrier signal generates the sending set mentioned above, the above-mentioned chip in the transmit data (here, it considers as the transmit data of the 4th sequence) of at least 1 sequence will not be transmitted among the transmit data of the 1st sequence - the 4th sequence. Therefore, the 4th recovery signal may turn into a signal with which the chip concerned was missing. For example, since a chip 504-3 is not transmitted when the peak power which exceeds a threshold to the multi-carrier signal generated at time T3 in a sending set is detected with reference to drawing 5 , in a receiving set, the 4th recovery signal turns into a signal with which the chip 504-3 was missing.

[0087] However, with reference to drawing 3 and drawing 5 , it is decomposed into two or more chips (namely, five chips of a chip 504-1 to 504-5) by diffusion process, and the symbol 304 is transmitted. Therefore, even if the 4th recovery signal is a signal lacking in a part of chips, in the back-diffusion-of-gas section 206-4, a suitable symbol judging can be performed using the 4th recovery signal by which back-diffusion-of-gas processing was carried out. Even when the chip 504-3 in the multi-carrier signal generated at time T3 is not specifically transmitted, based on the signal with which back-diffusion of gas of a chip 504-1, a chip 504-2, a chip 504-4, and the chip 504-5 was carried out, as for a symbol 304, a symbol judging is made appropriately.

[0088] Thus, the multi-carrier signal of a chip unit is generated by superimposing the information signal which carried out diffusion process to this subcarrier after preparing all the subcarriers as a subcarrier for transmitting an information signal rather than preparing the subcarrier which transmits first only the compensatory signal which oppresses a peak power fixed in the gestalt of this operation, and the subcarrier which transmits only an information signal. Thereby, decline in a transmission efficiency is suppressed.

[0089] Furthermore, when the peak power which exceeds a threshold to the multi-carrier signal in a certain chip did not occur, while transmitting the multi-carrier signal in this chip as it was, when the peak power which exceeds a threshold to the multi-carrier signal in a certain chip occurs, regeneration of the multi-carrier signal in this chip is carried out, without superimposing this chip in at least one transmit data on a subcarrier among the transmit data of two or more sequences. The peak power of the multi-carrier signal by which regeneration is carried out can be stopped by decreasing by this the number of the information signals superimposed in this chip. Therefore, the influence of the nonlinear distortion in power amplifier can be suppressed.

[0090] Moreover, each symbol is decomposed and transmitted to two or more chips by making diffusion process. A symbol judging is appropriately carried out by back-diffusion-of-gas processing, and each symbol is reproduced [in / receiving-side equipment / as a part of chips included in each symbol not being transmitted by this (it having been missing)]. As mentioned above, according to the gestalt of this operation, the peak power of a multi-carrier signal can be oppressed, suppressing decline in a transmission efficiency.

[0091] (Gestalt 3 of operation) The gestalt of this operation explains the case where the gestalt 2 of operation is applied to a MC-CDMA method. Drawing 7 is the block diagram showing the composition of the sending set equipped with the multi-carrier CDMA communication device concerning the gestalt 3 of operation of this invention. In addition, about the same composition as the gestalt 2 (drawing 6) of the operation in drawing 7 , the same sign as the thing in drawing 6 is attached, and detailed explanation is omitted. In drawing 7 , the diffusion section 701 performs diffusion process to the transmit data of one sequence, and outputs the transmit data of one sequence after diffusion process to the S/P transducer 101.

[0092] Drawing 8 is the block diagram showing the composition of the receiving set equipped with the multi-carrier CDMA communication device concerning the gestalt 3 of operation of this invention. In addition, about the same composition as the gestalt 2 (drawing 2) of the operation in drawing 8 , the same sign as the thing in drawing 2 is attached, and detailed explanation is omitted. In drawing 8 , the back-diffusion-of-gas section 801 outputs the decode data of one sequence by performing back-diffusion-of-gas processing to the signal of one sequence from the P/S transducer 207.

[0093] Subsequently, operation of the sending set and a receiving set equipped with the multi-carrier CDMA communication device concerning the gestalt of this operation is explained. First, in addition to drawing 3 and drawing 8 , operation of the above-mentioned sending set is explained with reference to drawing 9 and drawing 10 . In addition, detailed explanation is omitted about the same operation as the gestalt 2 of the operation in the gestalt of this operation.

[0094] Drawing 9 is the ** type view showing notionally the transmit data of one sequence after the diffusion process in the sending set equipped with the multi-carrier CDMA communication device concerning the gestalt 3 of operation of this invention. Drawing 10 is the ** type view showing notionally the transmit data of two or more sequences in the sending set equipped with the multi-carrier CDMA communication device concerning the gestalt 3 of operation of this invention.

[0095] In drawing 7 , diffusion process of the transmit data (transmit data [for four symbols]; here, refer to drawing 3 as an example) of one sequence is carried out by the diffusion section 701 with the diffusion sign of a diffusion coefficient 5. Thereby, the transmit data of one sequence becomes the signal (the 1st chip - the 5th chip) of the chip unit which the frequency band diffused 5 times, as shown in drawing 9 . For example, it is made into the signal of the chip unit which has a chip 901-1 - a chip 901-5 while the frequency band diffuses the transmit data of a symbol 301 5 times.

[0096] The transmit data of one sequence after diffusion process is changed into the transmit data of two or more sequences by the S/P transducer 101. It is equivalent to the number of sequences total number of subcarriers here (4x5). In addition, the transmit data of the 1st sequence - the 20th sequence is called, applying the transmit data of two or more sequences shown in drawing 7 for convenience of explanation to the lower part from the upper part. With reference to drawing 10 , the chip 901-1 of a symbol 301 - a chip 901-5 serve as transmit data of the 1st sequence - the 5th sequence here. The chip 902-1 of a symbol 302 - a chip 902-5 serve as transmit data of the 6th sequence - the 10th sequence. The chip 903-1 of a symbol 303 - a chip 903-5 serve as transmit data of the 11th sequence - the 15th sequence, and the chip 904-1 of a symbol 304 - a chip 904-5 serve as transmit data of the 16th sequence - the 20th sequence. Such transmit data of the 1st sequence - the 20th sequence is outputted to the selection section 601.

[0097] The selection section 601 is usually controlled by the transmitting halt carrier determination section 604 to output the transmit data of the 1st sequence - the 20th sequence to the IFFT section 602. Therefore, the transmit data of the 1st sequence - the 20th sequence is outputted to the IFFT section 602 from the selection section 601 to the IFFT section 602.

[0098] In the IFFT section 602, IFFT processing which used the transmit data of the 1st sequence after diffusion process - the 20th sequence is performed. The multi-carrier signal with which the 1st subcarrier - the 20th subcarrier were overlapped on the transmit data of the 1st sequence - the 20th sequence, respectively is generated per symbol by this IFFT processing. The generated multi-carrier signal is outputted to the peak-detection section 603.

[0099] In the peak-detection section 603, it is detected whether the peak power to which the power of the multi-carrier signal from the IFFT section 602 is measured per symbol, and exceeds a threshold to the multi-carrier signal in each symbol has occurred.

[0100] When the peak power which exceeds a threshold to the multi-carrier signal in a certain symbol has not occurred, the control signal of the purport which outputs the multi-carrier signal in this symbol to the D/A-conversion section 106 is outputted from the peak-detection section 603 to the IFFT section 602. Consequently, the multi-carrier signal in the symbol whose peak power is below a threshold is outputted from the IFFT section 602 to the D/A-conversion section 106.

[0101] On the contrary, when the peak power which exceeds a threshold to the multi-carrier signal in a certain symbol has occurred, while the control signal of the purport which performs regeneration of the multi-carrier signal in this symbol is outputted from the peak-detection section 603 to the IFFT section 602, the purport which the peak power exceeding a threshold generated is outputted to the multi-carrier signal in this symbol from the peak-detection section 603 to the transmitting halt carrier determination section 604.

[0102] In the transmitting halt carrier determination section 604, the transmit data which should be outputted to the IFFT section 602 among the transmit data of the 1st sequence - the 20th sequence is determined. The selection method of the transmit data which should be outputted to the IFFT section 602 is as the gestalt 2 of operation having explained. In addition, with the gestalt of this operation, the transmit data of the 1st sequence - the 19th sequence shall be determined as transmit data which should be outputted to the IFFT section 602.

[0103] Then, the control signal of the purport which outputs the transmit data of the sequence determined from the transmitting halt carrier determination section 604 to the selection section 601 to the IFFT section 602 is outputted. Consequently, the transmit data (the gestalt of this operation transmit data of the 1st sequence - the 19th sequence) of at least one sequence determined by the transmitting halt carrier determination section 604 among the transmit data of the 1st sequence after diffusion process - the 20th sequence is outputted to the IFFT section 602.

[0104] In the IFFT section 602, regeneration of the multi-carrier signal in the symbol which generated the peak power exceeding a threshold is performed. For example, when the peak power which exceeds a threshold to the multi-carrier signal in a certain symbol had occurred by the peak-detection section 603 with reference to drawing 10 and it is detected, in the IFFT section 602, regeneration of the multi-carrier signal with which the 1st subcarrier - the 19th subcarrier were overlapped on the transmit data (chip 904-4 of a symbol 304) of the transmit data (chip 901-1 of a symbol 301) of the 1st sequence - the 19th sequence, respectively is carried out. At the time of this regeneration, the 20th subcarrier is not overlapped on the transmit data (chip 904-5 of a symbol 304) of the 20th sequence. If it puts in another way, the 20th subcarrier is overlapped in an amplitude on the signal of abbreviation 0.

[0105] As the multi-carrier signal in which regeneration was carried out by the IFFT section 602 was mentioned above in the peak-detection section 603, detection of whether a peak power which exceeds a threshold has occurred is made. When the peak power to which processing which was mentioned above is made and exceeds a threshold in the peak-detection section 603 to the multi-carrier signal in a certain symbol by which regeneration was carried out has not occurred To the reverse to which the multi-carrier signal in this symbol by which regeneration was carried out from the IFFT section 602 to the D/A-conversion section 106 is outputted When the peak power which exceeds a threshold to the multi-carrier signal in a certain symbol by which regeneration was carried out has still occurred In the transmitting halt carrier determination section 604, after being changed according to the method which the transmit data which should be outputted to the IFFT section 602 mentioned above, in the IFFT section 602, regeneration of the multi-carrier signal in this symbol is performed. Henceforth, operation which was mentioned above is repeated until the peak power which exceeds a threshold to the multi-carrier signal in this symbol stops occurring.

[0106] Subsequently, operation of the above-mentioned receiving set is explained with reference to drawing 8 . In addition, detailed explanation is omitted about the same operation as the gestalt 1 (drawing 2) of the operation in drawing 8 .

[0107] In drawing 8 , each signal transmitted by the 1st subcarrier - the 20th subcarrier is extracted by carrying out FFT processing of the recovery signal changed into the digital signal in the FFT section 205. That is, the 1st recovery signal - 20th recovery signal is extracted by the FFT section 205.

[0108] The 1st recovery signal extracted by the FFT section 205 - the 20th recovery signal are changed into the signal of one sequence by the P/S transducer 207. In the back-diffusion-of-gas section 801, after back-diffusion-of-gas processing is carried out, the symbol judging of the signal of this one sequence is carried out. Thereby, the decode data of one sequence are generated.

[0109] Here, when the peak power which exceeds a threshold as a symbol with the generated multi-carrier signal generates the sending set mentioned above, the transmit data (here, it carries out to the transmit data 904-5 of the 20th sequence, i.e., the chip of a symbol 304) of at least 1 sequence will not be transmitted among the transmit data of the 1st sequence - the 20th sequence. Therefore, the 20th recovery signal may turn into a mistaken signal. For example, since the chip 904-5 of a symbol 304 is not transmitted when the peak power which exceeds a threshold to the multi-carrier signal of a symbol shown in drawing 10 in a sending set is detected with reference to drawing 10 , in a receiving set, the 20th recovery signal turns into a mistaken signal.

[0110] However, with reference to drawing 3 , drawing 9 , and drawing 10 , it is decomposed into two or more subcarriers (namely, the 16th subcarrier - the 20th subcarrier) by diffusion process, and the symbol 304 is transmitted. Therefore, even if it is the signal which the 20th recovery signal mistook, in the back-diffusion-of-gas section 801, a suitable symbol judging can be performed using the signal by which back-diffusion-of-gas processing was carried out. Specifically based on the signal with which back-diffusion of gas of a chip 904-1 - the chip 904-4 was carried out, as for a symbol 304, a symbol judging is made appropriately.

[0111] Thus, the multi-carrier signal of a symbol unit is generated by superimposing the information signal which carried out diffusion process to this subcarrier after preparing all the subcarriers as a subcarrier for transmitting an information signal rather than preparing the subcarrier which transmits first only the compensatory signal which oppresses a peak power fixed in the gestalt of this operation, and the subcarrier which transmits only an information signal. Thereby, decline in a transmission efficiency is suppressed.

[0112] Furthermore, when the peak power which exceeds a threshold to the multi-carrier signal in a certain symbol did not occur, while transmitting the multi-carrier signal in this symbol as it was, when the peak power which exceeds a threshold to the multi-carrier signal in a certain symbol occurs, regeneration of the multi-carrier signal in this symbol is carried out, without superimposing the transmit data of at least 1 sequence on a subcarrier among the transmit data of two or more sequences. The peak power of the multi-carrier signal by which regeneration is carried out can be stopped by decreasing by this the number of the information signals superimposed in this symbol. Therefore, the influence of the nonlinear distortion in power amplifier can be suppressed.

[0113] Moreover, each symbol is decomposed into two or more chips by diffusion process, and each decomposed chip is superimposed and transmitted to a subcarrier peculiar to a chip. Though a part of chips included in each symbol are not transmitted by this, in receiving-side equipment, a symbol judging is appropriately carried out by back-diffusion-of-gas processing, and each symbol is reproduced.

[0114] As mentioned above, according to the gestalt of this operation, the peak power of a multi-carrier signal can be oppressed, suppressing decline in a transmission efficiency.

[0115] (Gestalt 4 of operation) The case where transmission by the subcarrier beforehand defined among all subcarriers is stopped by the gestalt of this operation in the gestalt 2 of operation about the multi-carrier signal with which a peak power exceeds a threshold is explained. Drawing 11 is the block diagram showing the composition of the sending set equipped with the multi-carrier CDMA communication device concerning the gestalt 4 of operation of this invention. In addition, about the same composition as the gestalt 2 (drawing 6) of the operation in drawing 11 , the same sign as the thing in drawing 6 is attached, and detailed explanation is omitted.

[0116] In drawing 11 , the transmitting halt section 1101 controls the output to the IFFT section 602 of the transmit data of the 1st sequence according to the detection result from the peak-detection section 603. The transmitting halt section 1102 controls the output to the IFFT section 602 of the transmit data of the 4th sequence according to the detection result from the peak-detection section 603.

[0117] About the composition of the receiving set equipped with the multi-carrier CDMA communication device concerning the gestalt of this operation, since it is the same as that of the gestalt 1 (drawing 2) of operation, detailed explanation is omitted.

[0118] Subsequently, operation of the above-mentioned sending set is explained. In addition, detailed explanation is omitted about the same operation as the gestalt 2 of the operation in the gestalt of this operation. In the peak-detection section 603, it is detected whether the peak power to which the power of the multi-carrier signal from the IFFT section 602 is measured per chip, and exceeds a threshold to the multi-carrier signal in each chip like the gestalt 2 of operation has occurred.

[0119] When the peak power which exceeds a threshold to the multi-carrier signal in a certain chip has occurred, while the control signal of the purport which performs regeneration of the multi-carrier signal in this chip is outputted from the peak-detection section 603 to the IFFT section 602, the purport which the peak power exceeding a threshold generated is outputted to the multi-carrier signal in this chip from the peak-detection section 603 to the transmitting halt section 1101 and the transmitting halt section 1102.

[0120] Consequently, the output to the IFFT section 602 of the transmit data of the 1st sequence is suspended by the transmitting halt section 1101, and the output to the IFFT section 602 of the transmit data of the 4th sequence is suspended by the transmitting halt section 1102. That is, only the transmit data of the 2nd sequence and the 3rd sequence is outputted to the IFFT section 602 among the transmit data of the 1st sequence after diffusion process - the 4th sequence.

[0121] In the IFFT section 602, regeneration of the multi-carrier signal with which the 2nd subcarrier and the 3rd *subcarrier were overlapped on the transmit data of the 2nd sequence after diffusion process and the 3rd sequence*, respectively is carried out. At the time of this regeneration, the 1st subcarrier and the 4th subcarrier are not overlapped on the transmit data of the 1st sequence and the 4th sequence, respectively. If it puts in another way, the 1st subcarrier and the 4th subcarrier are overlapped in an amplitude on the signal of abbreviation 0. Henceforth, processing which was explained with the gestalt 2 of operation is made.

[0122] In addition, although the gestalt of this operation explained the case where the two transmitting halt sections which suspend the output of the transmit data to the IFFT section 602 at the time of the regeneration of a multi-carrier signal were prepared, there is no limitation in the number of these transmitting halt sections.

[0123] Moreover, although the gestalt of this operation explained the case where the output to the IFFT section 602 of transmit data was stopped by two or more transmitting halt sections (namely, the transmitting halt section 1101 and the transmitting halt section 1102) of all at the time of the regeneration of the 1st multi-carrier signal You may make it make the number of the transmitting halt sections which stop the output to the IFFT section 602 of transmit data increase according to the number of times of the regeneration of a multi-carrier signal. Thereby, let quality of the input signal in a receiving set be a better thing.

[0124] Thus, in the gestalt of this operation, the subcarrier which stops transmission of transmit data at the time of the regeneration of a multi-carrier signal is set up beforehand. Therefore, when the permission quality of the transmit data transmitted differs for every subcarrier, the quality of the transmit data transmitted by the subcarrier which stops transmission of transmit data, then subcarriers other than this in the subcarrier low quality is sufficient as whose quality of the transmit data transmitted among all subcarriers can be kept good. Thereby, stopping the peak power of a multi-carrier signal, transmit data can be transmitted so that the quality demanded may be filled.

[0125] (Gestalt 5 of operation) The gestalt of this operation explains the case where the gestalt 3 of operation is applied to a MC-CDMA method. Drawing 12 is the block diagram showing the composition of the sending set equipped with the multi-carrier CDMA communication device concerning the gestalt 5 of operation of this invention. In addition, about the same composition as the gestalt 4 (drawing 11) of the operation in drawing 11 , the same sign as the thing in drawing 11 is attached, and detailed explanation is omitted.

[0126] As shown in drawing 12 , the sending set equipped with the multi-carrier CDMA communication device concerning the gestalt of this operation removes the diffusion section 102-1 to 102-4 from the sending set (drawing 11) concerning the gestalt 4 of operation, and has the composition which formed the diffusion section 701 in the sending set concerning the gestalt 4 of operation. This diffusion section 701 is the same as that of the thing in the sending set (drawing 7) of the gestalt 3 of operation.

[0127] In addition, about the composition of the receiving set equipped with the multi-carrier CDMA communication device concerning the gestalt of this operation, since it is the same as that of the receiving set in the gestalt 3 of operation, detailed explanation is omitted.

[0128] Thus, in the gestalt of this operation, the subcarrier which stops transmission of transmit data at the time of the regeneration of a multi-carrier signal is set up beforehand. Therefore, when the permission quality of the transmit data transmitted differs for every subcarrier, the quality of the transmit data transmitted by the subcarrier which stops transmission of transmit data, then subcarriers other than this in the subcarrier low quality is sufficient as whose quality of the transmit data transmitted among all subcarriers can be kept good. Thereby, stopping the peak power of a multi-carrier signal, transmit data can be transmitted so that the quality demanded may be filled.

[0129] (Gestalt 6 of operation) The gestalt of this operation explains the case where the transmit data which performed error correcting code-ization is superimposed to the subcarrier which performs a transmitting halt, in the gestalt 4 of operation. Drawing 13 is the block diagram showing the composition of the sending set equipped with the multi-carrier CDMA communication device concerning the gestalt 6 of operation of this invention. In addition, about the same composition as the gestalt 4 (drawing 11) of the operation in drawing 13 , the same sign as the thing in drawing 11 is attached, and detailed explanation is omitted.

[0130] As shown in drawing 13 , the sending set equipped with the multi-carrier CDMA communication device concerning the gestalt of this operation has the composition which replaced with the S/P transducer 101, formed the S/P transducer 1301, and formed the error correcting code-ized section 1302 and the error correcting code-ized section

1303 in the sending set (drawing 11) concerning the gestalt 4 of operation.

[0131] The S/P transducer 1301 has the same composition as the S/P transducer 101 except for the following point. That is, in order to make the same the rate of the transmit data inputted into the diffusion section 102-1 to 102-4, the S/P transducer 1301 outputs the transmit data of a standard rate as transmit data of the 2nd sequence and the 3rd sequence, and outputs the transmit data of a low rate as transmit data of the 1st sequence and the 4th sequence.

[0132] To the transmit data of the 1st sequence and the 4th sequence, the error correcting code-ized section 1302 and the error correcting code-ized section 1303 perform predetermined error correcting code-ized processing, and output the transmit data after error correcting code-ized processing to the diffusion section 102-1 and the diffusion section 102-4, respectively.

[0133] Drawing 14 is the block diagram showing the composition of the receiving set equipped with the multi-carrier CDMA communication device concerning the gestalt 6 of operation of this invention. In addition, about the same composition as the gestalt 1 (drawing 2) of the operation in drawing 14 , the same sign as the thing in drawing 2 is attached, and detailed explanation is omitted.

[0134] As shown in drawing 14 , the receiving set equipped with the multi-carrier CDMA communication device concerning the gestalt of this operation has the composition which replaced with the P/S transducer 207, formed the P/S transducer 1403, and formed the error correction decryption section 1401 and the error correction decryption section 1402 in the receiving set (drawing 2) concerning the gestalt 1 of operation.

[0135] the [the 1st recovery signal with which the symbol judging of the error correction decryption section 1401 and the error correction decryption section 1402 was carried out, respectively, and] -- to 4 recovery signals, error correction decryption processing is performed and the recovery signal after error correction decryption processing is outputted to the P/S transducer 1403 The P/S transducer 1403 changes the recovery signal of two or more sequences from the back-diffusion-of-gas section 206-2 and the back-diffusion-of-gas section 206-3 into the decode data of one sequence at the error correction decryption section 1401 and error correction decryption section 1402 row.

[0136] Subsequently, operation of the above-mentioned sending set is explained. In addition, detailed explanation is omitted about the same operation as the gestalt 4 of the operation in the gestalt of this operation. The transmit data of one sequence is changed into the transmit data of the 2nd sequence of a standard rate, and the 3rd sequence, and the transmit data of the 1st sequence of a low rate, and the 4th sequence by the S/P transducer 1301 in drawing 13 .

[0137] The transmit data of the 2nd sequence of a standard rate and the 3rd sequence is outputted to the diffusion section 102-2 and the diffusion section 102-3, respectively. The transmit data of the 1st sequence of a low rate and the 4th sequence is outputted to the diffusion section 102-1 and the diffusion section 102-4 by them, respectively, after predetermined error correcting code-ized processing is made by the error correcting code-ized section 1302 and the error correcting code-ized section 1303. The rate of each transmit data inputted into the diffusion section 102-1 to 102-4 is the same.

[0138] It is also possible to use the error correcting code-ized processing using the block code (a Hamming code, a BCH code, a Reed Solomon code, and fire code) as the above-mentioned predetermined error correcting code-ized processing here, and it is also possible to use the error correcting code-ized processing using convolutional codes (a turbo sign, a self-orthogonal code, a HAGERU hamburger sign, the Iwadare sign, etc.).

[0139] Subsequently, operation of the above-mentioned receiving set is explained. In addition, detailed explanation is omitted about the same operation as the gestalt 1 of the operation in the gestalt of this operation. the [the 2nd recovery signal by which the symbol judging was carried out in drawing 14 , and] -- 3 recovery signals are outputted to the P/S transducer 1403 the [the 1st recovery signal by which the symbol judging was carried out, and] -- 4 recovery signals are outputted to the P/S transducer 1403, after the error correction decryption processing corresponding to error correcting code-ized processing in which it was used by the error correction decryption section 1401 and the error correction decryption section 1402 in the sending set is made, respectively

[0140] the [the 2nd recovery signal by which the symbol judging was carried out, and] -- the [the 1st recovery signal by which error correction decryption processing was carried out at 3 recovery signals and the row, and] -- 4 recovery signals are changed into the decode data of one sequence by the P/S transducer 1403

[0141] Thus, in the gestalt of this operation, the transmit data by which error correcting code-ized processing was made is superimposed to the subcarrier to which a sending set performs a transmitting halt, and the receiving set is performing error correction decryption processing to the signal transmitted by this subcarrier. Thereby, a receiving set can reproduce transmit data correctly by performing error correction decryption processing to this signal, even if it cannot decode appropriately the signal transmitted by this subcarrier.

[0142] (Gestalt 7 of operation) The gestalt of this operation explains the case where the signal for oppressing a peak power to at least one subcarrier about the multi-carrier signal with which a peak power exceeds a threshold among all subcarriers is superimposed, in the gestalt 6 of the gestalt 2 of operation - operation. Here, it explains using the gestalt

6 of operation as an example.

[0143] Drawing 15 is the block diagram showing the composition of the sending set equipped with the multi-carrier CDMA communication device concerning the gestalt 7 of operation of this invention. In addition, about the same composition as the gestalt 6 (drawing 13) of the operation in drawing 15 , the same sign as the thing in drawing 13 is attached, and detailed explanation is omitted.

[0144] As shown in drawing 15 , the sending set equipped with the multi-carrier CDMA communication device concerning the gestalt of this operation has the composition which replaced with the transmitting halt section 1101 and the transmitting halt section 1102, formed the change section 1501 and the change section 1502, and formed the peak suppression signal generator 1503 in the sending set (drawing 13) concerning the gestalt 6 of operation. The peak suppression signal generator 1503 outputs a peak suppression signal to the change section 1501 and the change section 1502 according to the detection result from the peak-detection section 603.

[0145] When a peak suppression signal is sent from the peak suppression signal generator 1503, the change section 1501 and the change section 1502 are replaced with the transmit data of the 1st sequence and the 4th sequence, respectively, and output this peak suppression signal to the IFFT section 602.

[0146] About the composition of the receiving set equipped with the multi-carrier CDMA communication device concerning the gestalt of this operation, since it is the same as that of the receiving set (drawing 14) concerning the gestalt 6 of operation, detailed explanation is omitted.

[0147] Subsequently, operation of the above-mentioned sending set is explained. In addition, detailed explanation is omitted about the same operation as the gestalt 6 of the operation in the gestalt of this operation. In drawing 15 , the change section 1501 and the change section 1502 usually output the transmit data of the 1st sequence and the 4th sequence to the IFFT section 602, respectively. Therefore, the transmit data of the 1st sequence by which diffusion process was carried out - the 4th sequence is inputted into the IFFT section 602.

[0148] In the IFFT section 602, IFFT processing which used the transmit data of the 1st sequence after diffusion process - the 4th sequence is performed. Thereby, the multi-carrier signal with which the 1st subcarrier - the 4th subcarrier were overlapped on the transmit data of the 1st sequence after diffusion process - the 4th sequence, respectively is generated. The multi-carrier signal of the generated chip unit is outputted to the peak-detection section 603.

[0149] In the peak-detection section 603, it is detected whether the peak power to which the power of the multi-carrier signal from the IFFT section 602 is measured per chip, and exceeds a threshold to the multi-carrier signal in each chip has occurred. When the peak power which exceeds a threshold to the multi-carrier signal in a certain chip has not occurred, the control signal of the purport which outputs the multi-carrier signal in this chip to the D/A-conversion section 106 is outputted from the peak-detection section 603 to the IFFT section 602. Consequently, the multi-carrier signal in the chip whose peak power is below a threshold is outputted from the IFFT section 602 to the D/A-conversion section 106.

[0150] On the contrary, when the peak power which exceeds a threshold to the multi-carrier signal in a certain chip has occurred, while the control signal of the purport which performs regeneration of the multi-carrier signal in this chip is outputted from the peak-detection section 603 to the IFFT section 602, the purport which the peak power exceeding a threshold generated is outputted to the multi-carrier signal in this chip from the peak-detection section 603 to the peak suppression signal generator 1503.

[0151] Then, a peak suppression signal is outputted from the peak suppression signal generator 1503 to the change section 1501 and the change section 1502. A suitable (it is random) signal is used as a peak suppression signal. Moreover, you may make it use the signal searched for by calculation as a peak suppression signal besides the random signal. Furthermore, the signal searched for by calculation is beforehand stored in ROM etc., and you may make it the peak suppression signal generator 1503 generate a peak suppression signal using this ROM. In addition, it is good also as a signal which is good for mutual also as the same signal, and is mutually different in the peak suppression signal outputted to the change section 1501 and the change section 1502.

[0152] It replaces with the transmit data of the 1st sequence and the 4th sequence to the IFFT section 602, respectively from the change section 1501 which received the peak suppression signal, and the change section 1502, and this peak suppression signal is outputted.

[0153] In the IFFT section 602, regeneration of the multi-carrier signal in the chip which generated the peak power exceeding a threshold is performed. for example, when the peak power which exceeds a threshold to the multi-carrier signal in the chip corresponding to time T3 had occurred by the peak-detection section 603 with reference to drawing 5 and it is detected In the IFFT section 602, replace with the chip 501-3 in the transmit data of the 1st sequence, and the 1st subcarrier is overlapped on a peak suppression signal. Replace with the chip 504-3 in the transmit data of the 4th sequence, and the 4th subcarrier is overlapped on a peak suppression signal. The 2nd subcarrier and the 3rd subcarrier are overlapped on the chip 502-3 in the transmit data of the 2nd sequence, and the chip 503-3 in the transmit data of the 3rd sequence, respectively, and regeneration of the multi-carrier signal is carried out.

[0154] Here, since the peak suppression signal inputted into the IFFT section 602 is a suitable (it is random) signal, it can be called signal which may oppress the peak power of the multi-carrier signal in which regeneration is carried out by the IFFT section 602. Therefore, the OFDM signal in which regeneration was carried out by the IFFT section 602 has high possibility that a peak power will become a repressed thing.

[0155] As the multi-carrier signal in which regeneration was carried out by the IFFT section 602 was mentioned above in the peak-detection section 603, detection of whether a peak power which exceeds a threshold has occurred is made. When the peak power to which processing which was mentioned above is made and exceeds a threshold in the peak-detection section 603 to the multi-carrier signal in a certain chip by which regeneration was carried out has not occurred To the reverse to which the multi-carrier signal in this chip by which regeneration was carried out from the IFFT section 602 to the D/A-conversion section 106 is outputted When the peak power which exceeds a threshold to the multi-carrier signal in a certain chip by which regeneration was carried out has still occurred In the IFFT section 602 after another, suitable (it is random) signal was outputted from the peak suppression signal generator 1503 as a peak suppression signal to the change section 1501 and the change section 1502 Regeneration of the multi-carrier signal in this chip is performed using the changed peak suppression signal. Henceforth, operation which was mentioned above is repeated until the peak power which exceeds a threshold to the multi-carrier signal in this chip stops occurring.

[0156] In addition, although the gestalt of this operation explained the case where the total of the subcarrier which superimposes a peak suppression signal was set to 2, there is no limitation in the total of the subcarrier which superimposes a peak suppression signal.

[0157] Moreover, when two or more subcarriers which superimpose a peak suppression signal have profited, you may make it make the number of the subcarriers which superimpose a peak suppression signal increase with the gestalt of this operation according to the number of times of the regeneration of a multi-carrier signal at the time of the regeneration of a multi-carrier signal. Thereby, let the property of the input signal in a receiving set be a better thing, stopping the peak power of a multi-carrier signal certainly.

[0158] Furthermore, although the gestalt of this operation explained the case where a peak suppression signal was used in the gestalt 6 of operation as an example, it cannot be overemphasized that it is possible to use a peak suppression signal for all of the gestalten 2-6 of operation.

[0159] Thus, the multi-carrier signal of a chip unit is generated by superimposing the information signal which carried out diffusion process to this subcarrier after preparing all the subcarriers as a subcarrier for transmitting an information signal rather than preparing the subcarrier which transmits first only the compensatory signal which oppresses a peak power fixed in the gestalt of this operation, and the subcarrier which transmits only an information signal. Thereby, decline in a transmission efficiency is suppressed.

[0160] furthermore, when the peak power which exceeds a threshold to the multi-carrier signal in a certain chip (a MC-CDMA method symbol) does not occur While transmitting the multi-carrier signal in this chip (symbol) as it is When the peak power which exceeds a threshold to the multi-carrier signal in a certain chip (symbol) occurs More than one are replaced with this chip in at least one transmit data among the transmit data of a sequence, a peak suppression signal is superimposed on a subcarrier, and regeneration of the multi-carrier signal in this chip (symbol) is carried out. The peak power of the multi-carrier signal by which regeneration is carried out can be stopped by decreasing by this the number of the information signals superimposed in this chip (symbol). Therefore, the influence of the nonlinear distortion in power amplifier can be suppressed.

[0161] Moreover, each symbol is decomposed and transmitted to two or more chips by making diffusion process (in MC-CDMA, each symbol is decomposed into two or more chips by diffusion process, and each decomposed chip is superimposed and transmitted to a subcarrier peculiar to a chip). A symbol judging is appropriately carried out by back-diffusion-of-gas processing, and each symbol is reproduced [in / receiving-side equipment / as a part of chips included in each symbol not being transmitted by this (it having been missing)]. As mentioned above, according to the gestalt of this operation, the peak power of a multi-carrier signal can be oppressed, suppressing decline in a transmission efficiency.

[0162] (Gestalt 8 of operation) The gestalt of this operation explains the case where clipping processing is performed to the generated multi-carrier signal or the multi-carrier signal by which regeneration was carried out, in the gestalt 7 of the gestalt 1 of operation - operation. Here, it explains using the gestalt 7 of operation as an example.

[0163] Drawing 16 is the block diagram showing the composition of the sending set equipped with the multi-carrier CDMA communication device concerning the gestalt 8 of operation of this invention. In addition, about the same composition as the gestalt 7 (drawing 15) of the operation in drawing 16 , the same sign as the thing in drawing 15 is attached, and detailed explanation is omitted.

[0164] The sending set equipped with the multi-carrier CDMA communication device concerning the gestalt of this operation as shown in drawing 16 has the composition which replaced with the IFFT section 602, formed the IFFT section 1601, replaced with the peak-detection section 603, formed the peak-detection section 1602, and formed the clipping circuit 1603 in the sending set (drawing 15) concerning the gestalt 7 of operation.

[0165] The peak-detection section 1602 has the same composition as the peak-detection section 603 in the gestalt 7 of operation except for the following point. That is, the peak-detection section 1602 controls the IFFT section 1601 to output the multi-carrier signal first generated about this chip (symbol) to a clipping circuit 1603 to stop the regeneration of the multi-carrier signal about this chip (symbol), when the number of times of the regeneration of the multi-carrier signal in the same chip (MC-CDMA symbol) reaches a predetermined number.

[0166] The IFFT section 1601 has the same composition as IFFT602 in the gestalt 7 of operation except for the following point. That is, the IFFT section 1601 outputs the held multi-carrier signal to a clipping circuit 1603 while it holds the multi-carrier signal generated to the beginning about a certain chip (symbol) and performs generation and regeneration of a multi-carrier signal in response to control of the peak-detection section 1602.

[0167] A clipping circuit 1603 performs clipping processing to the multi-carrier signal from the IFFT section 1601, and outputs the multi-carrier signal after clipping processing to the D/A-conversion section 106.

[0168] Subsequently, operation of the above-mentioned sending set is explained. In addition, detailed explanation is omitted about the same operation as the gestalt 7 of the operation in the gestalt of this operation. In drawing 16 , the generated multi-carrier signal is held in the IFFT section 1601 at the generate time of the multi-carrier signal of the beginning about a certain chip (symbol). The multi-carrier signal which the peak power exceeding a threshold has not generated is outputted to the D/A-conversion section 106, as the gestalt of the above-mentioned implementation explained.

[0169] On the other hand, regeneration of the multi-carrier signal in this chip (symbol) is performed by the IFFT section 1601 until the peak power in the multi-carrier signal by which regeneration was carried out becomes below a threshold when the peak power which exceeds a threshold to the multi-carrier signal in a certain chip (symbol) by the peak-detection section 1602 occurs, as mentioned above.

[0170] The control signal of a purport with which it outputs the held multi-carrier signal to a clipping circuit 1603 while it stops the regeneration of the multi-carrier signal in this chip (symbol) from the peak-detection section 1602 to the IFFT section 1601, when it is detected by the peak-detection section 1602 that the number of times of the regeneration of the multi-carrier signal about the same chip (symbol) reached the predetermined number at this time is outputted.

[0171] Consequently, in the IFFT section 1601, while the regeneration of the multi-carrier signal about a certain chip (symbol) is stopped, the held multi-carrier signal is outputted to a clipping circuit 1603.

[0172] In a clipping circuit 1603, clipping processing is made to the multi-carrier signal from the IFFT section 1601. The method which cuts the power more than the threshold in a multi-carrier signal as clipping processing, the method which makes below a threshold the peak power of this multi-carrier signal by lowering the overall level of a multi-carrier signal are used.

[0173] In addition, although the case where clipping processing was performed to the multi-carrier signal generated first was explained with the gestalt of this operation when the number of times of the regeneration of the multi-carrier signal in the same chip (symbol) reached a predetermined number, you may be made to perform clipping processing to the multi-carrier signal by which regeneration was carried out. In the multi-carrier signal which carried out regeneration by stopping transmission by the predetermined subcarrier by this, in the case where the suppression effect of a peak power is inadequate, and the multi-carrier signal which superimposed and carried out regeneration of the peak suppression signal, even when the suppression effect of a peak power is inadequate, the peak power of a multi-carrier signal can be oppressed certainly.

[0174] Moreover, although the gestalt of this operation explained the case where clipping processing was performed to a multi-carrier signal in the gestalt 7 of operation as an example, it cannot be overemphasized that it is possible to perform clipping processing also in any of the gestalten 1-6 of operation. That is, the peak power of a multi-carrier signal can be oppressed, shortening the processing time by performing clipping processing to a multi-carrier signal, when searching for the subcarrier which stops transmission, or when searching for the subcarrier which superimposes a peak suppression signal and it cannot search for the subcarrier which the peak power of a multi-carrier signal becomes below a threshold within a predetermined number.

[0175] Thus, the peak power in a multi-carrier signal can be oppressed certainly, shortening the processing time by performing clipping processing to the generated multi-carrier signal or the multi-carrier signal by which regeneration was carried out according to the gestalt of this operation.

[0176] In addition, in the gestalt 8 of the gestalt 1 of the above-mentioned implementation - operation, when there were few subcarriers, the input configuration to the IFFT section was restricted. Therefore, it becomes possible to make a look-up table (LUT) memorize the IFFT result of an operation calculated off-line beforehand. An equipment scale can be suppressed while the amount of operations and the processing time in IFFT processing are reducible by replacing with and using this LUT for the IFFT section. Moreover, it combines, respectively and the gestalt 8 of the gestalt 1 of the above-mentioned implementation - operation can be used. The multi-carrier CDMA communication device concerning this invention can be carried in the communication terminal and base station equipment in digital mobile communication system etc.

[0177]

[Effect of the Invention] As explained above, according to this invention, superimpose an information signal to all subcarriers and a multi-carrier signal is generated. When the peak power which exceeds a threshold to the generated multi-carrier signal occurs, [whether this multi-carrier signal is transmitted and] Or since regeneration of the multi-carrier signal at the time of superimposing the signal for oppressing a peak power to at least one subcarrier among all subcarriers, and a peak power exceeding a threshold is carried out The multi-carrier CDMA communication device which oppresses the peak power of a multi-carrier signal can be offered suppressing decline in a transmission efficiency.

[Translation done.]

* NOTICES *

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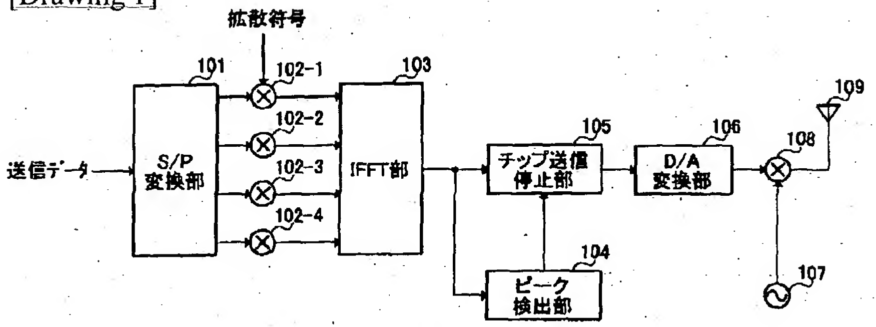
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]


拡散符号
101
102-1
103
109
102-2
105
106
108
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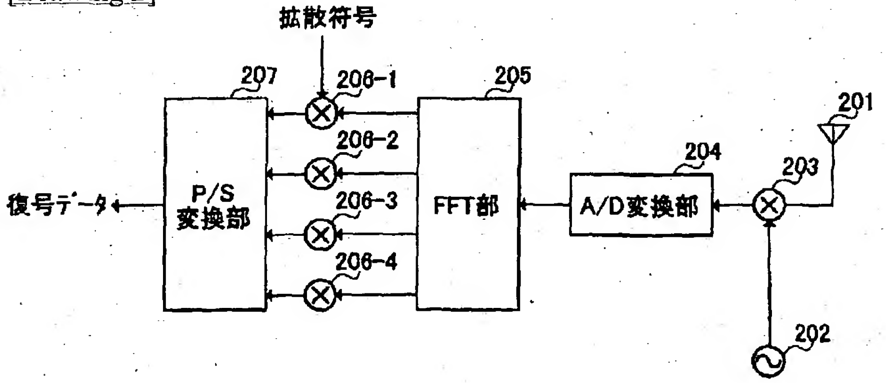
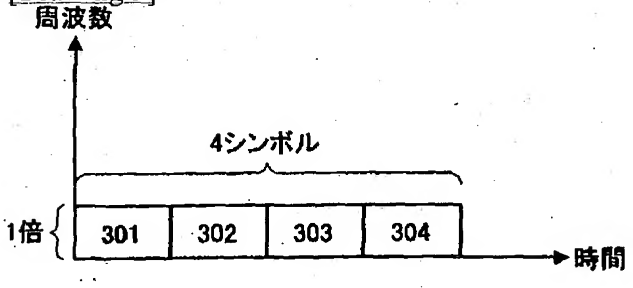
S/P 変換部
102-3
IFFT部
チップ送信停止部
D/A 変換部
102-4
104
ピーク検出部
107

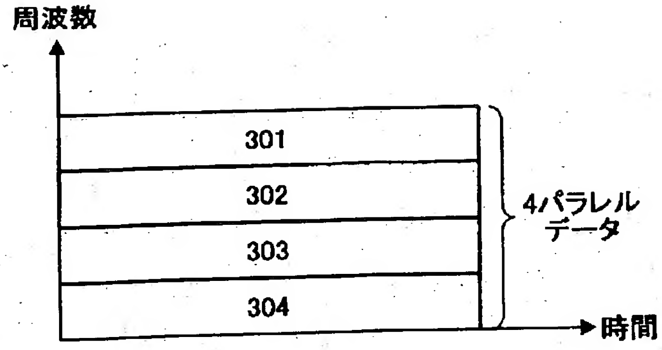
[Drawing 2]


拡散符号
207
206-1
205
201
206-2
204
203
復号データ
P/S 変換部
206-3
FFT部
A/D変換部
206-4
202

[Drawing 3]


周波数
4シンボル
1倍
301
302
303
304
時間

[Drawing 4]


周波数
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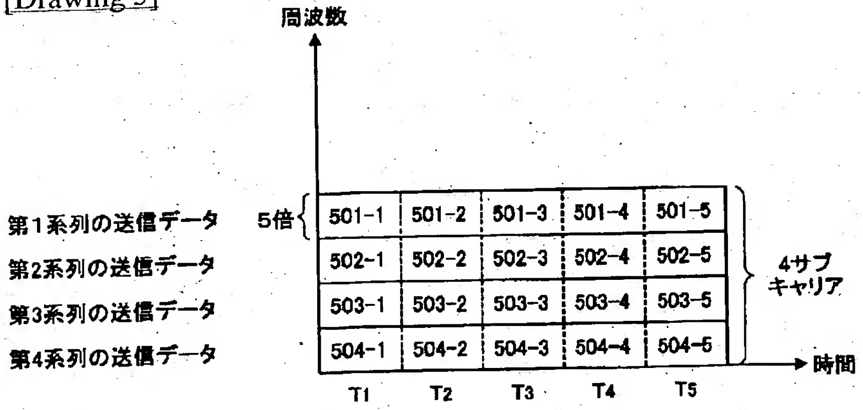
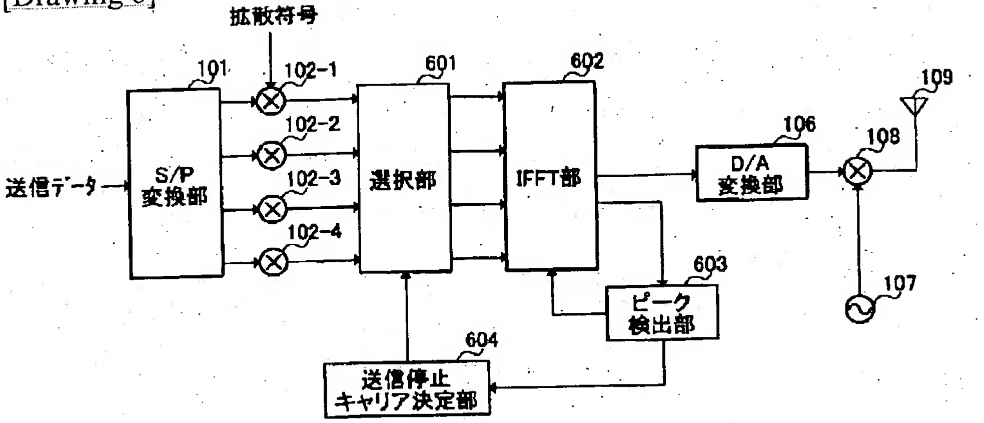
302
303
304
4パラレル
データ
時間

[Drawing 5]


周波数
第1系列の送信データ
第2系列の送信データ
第3系列の送信データ
第4系列の送信データ
5倍
501-1
501-2
501-3
501-4
501-5
502-1
502-2
502-3
502-4
502-5
503-1
503-2
503-3
503-4
503-5
504-1
504-2
504-3
504-4
504-5
4サブ
キャリア
時間
T1
T2
T3
T4
T5

[Drawing 6]


拡散符号
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102-2
102-3
102-4
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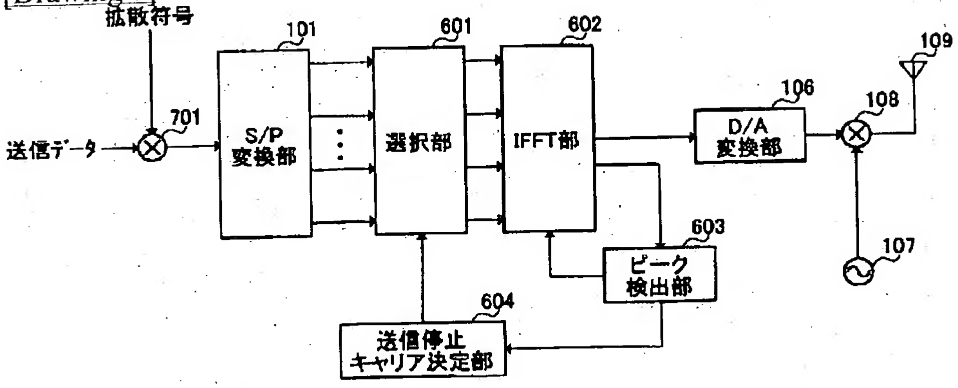
602
109
106
108
送信データ
S/P
変換部
選択部
IFFT部
D/A
変換部
603
ピーク
検出部
107
604
送信停止
キャリア決定部

[Drawing 7]


拡散符号
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601
602
109
106
108
701
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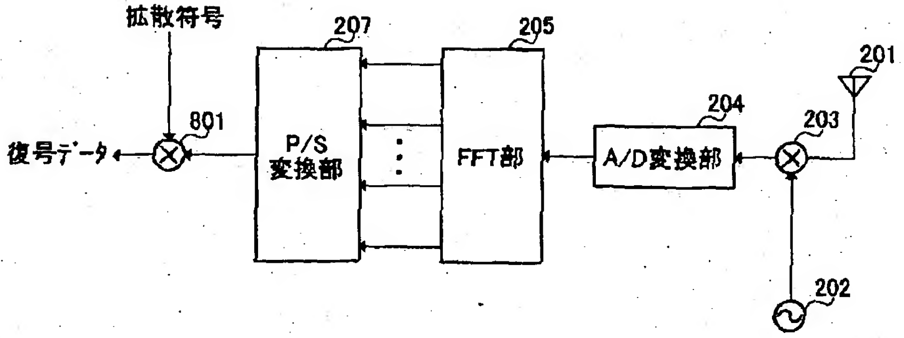
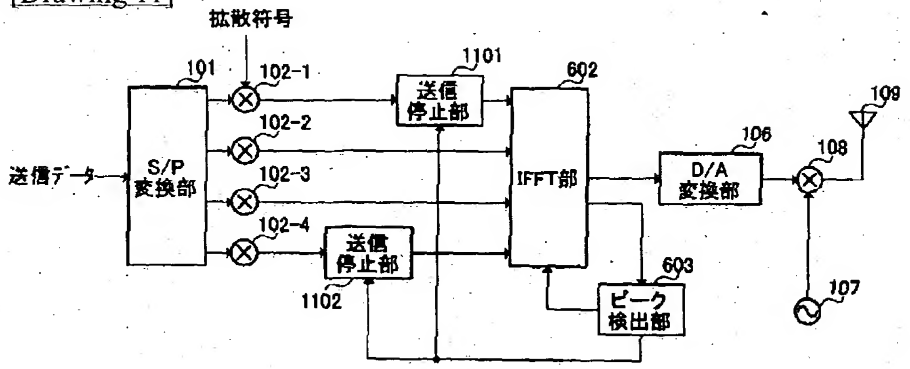
S/P
変換部
選択部
IFFT部
D/A
変換部
603
ピーク
検出部
107
604
送信停止
キャリア決定部

[Drawing 8]


拡散符号
207
205
201
204
203
801
P/S
変換部
FFT部
A/D変換部
復号データ
202

[Drawing 11]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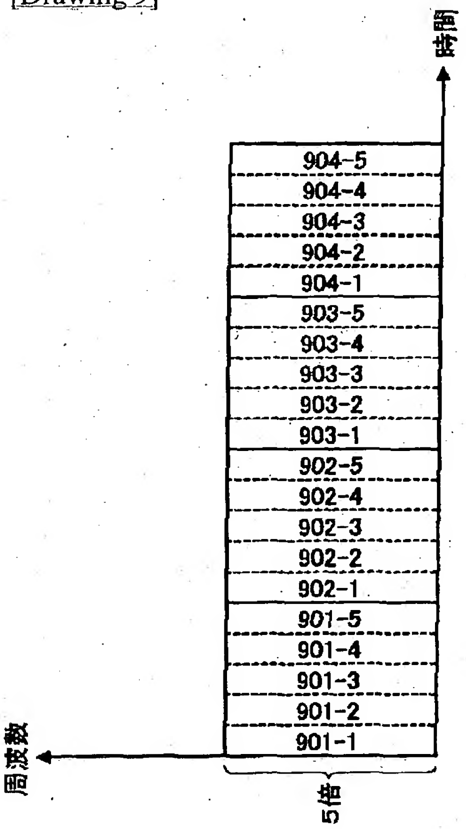
101
102-1
1101
送信
停止部
602
109
102-2
106
108
送信データ
S/P
変換部
102-3
IFFT部
D/A
変換部
102-4
送信
停止部
603
ピーク
検出部
1102
107

[Drawing 9]


時間
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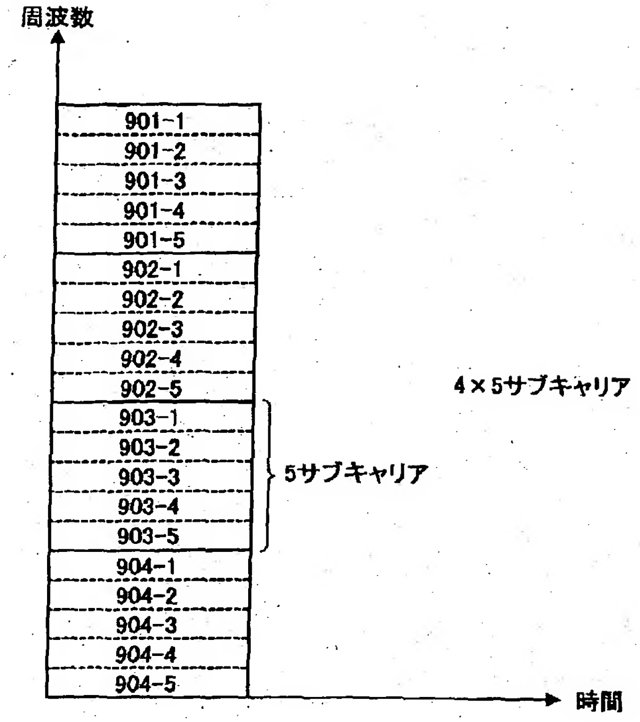
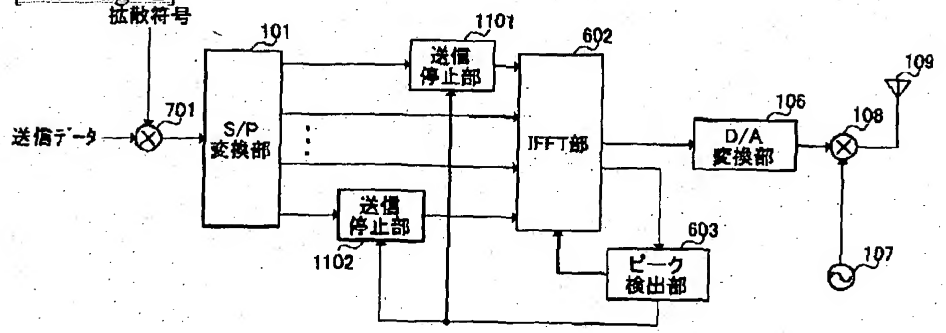
904-4
904-3
904-2
904-1
903-5
903-4
903-3
903-2
903-1
902-5
902-4
902-3
902-2
902-1
901-5
901-4
901-3
901-2
901-1
周波数
5倍

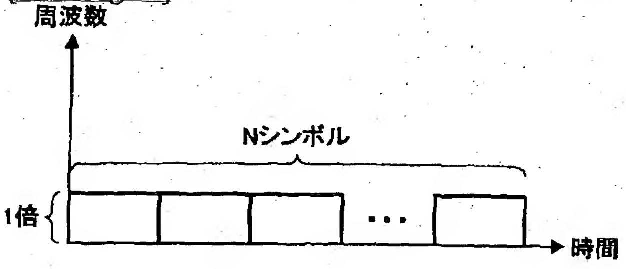
[Drawing 10]


周波数
901-1
901-2
901-3
901-4
901-5
902-1
902-2
902-3
902-4
902-5
903-1
903-2
903-3
903-4
903-5
904-1
904-2
904-3
904-4
904-5
4×5サブキャリア
5サブキャリア
時間

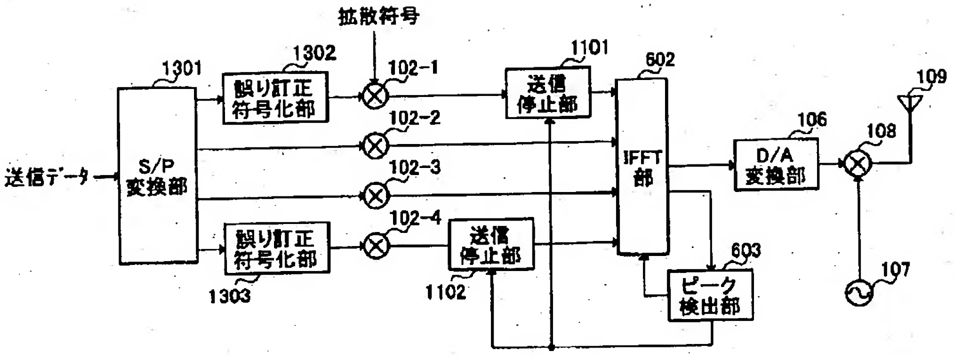
[Drawing 12]


拡散符号
送信データ
701
101
S/P
変換部
1101
送信
停止部
1102
送信
停止部
602
IFFT部
603
ピーク
検出部
106
D/A
変換部
108
107
109

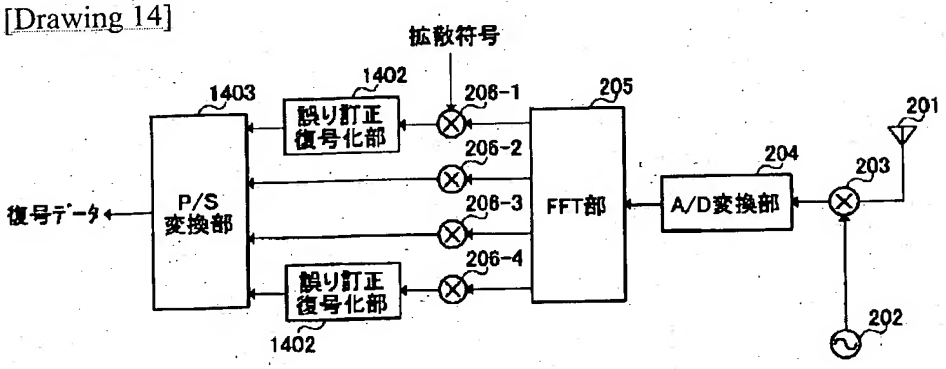
[Drawing 18]


周波数
Nシンボル
1倍
時間

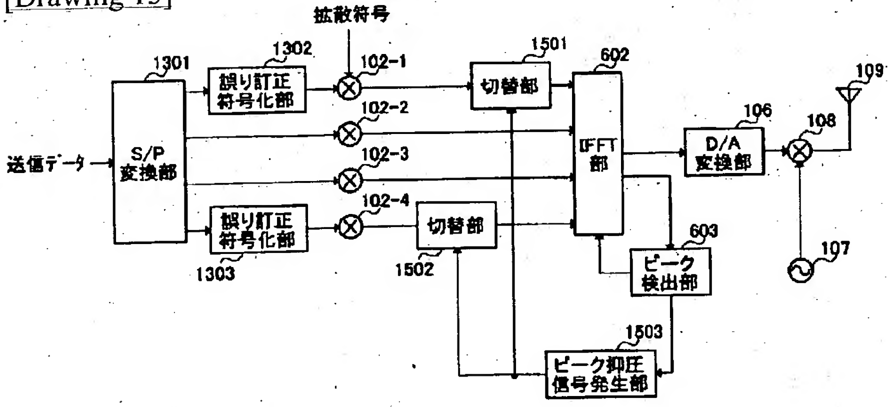
[Drawing 13]


拡散符号
1301
1302
誤り訂正符号化部
102-1
1101
送信停止部
602
109
102-2
106
108
送信データ
S/P変換部
IFFT部
D/A変換部
102-3
102-4
誤り訂正符号化部
送信停止部
603
107
ピーク検出部
1303
1102

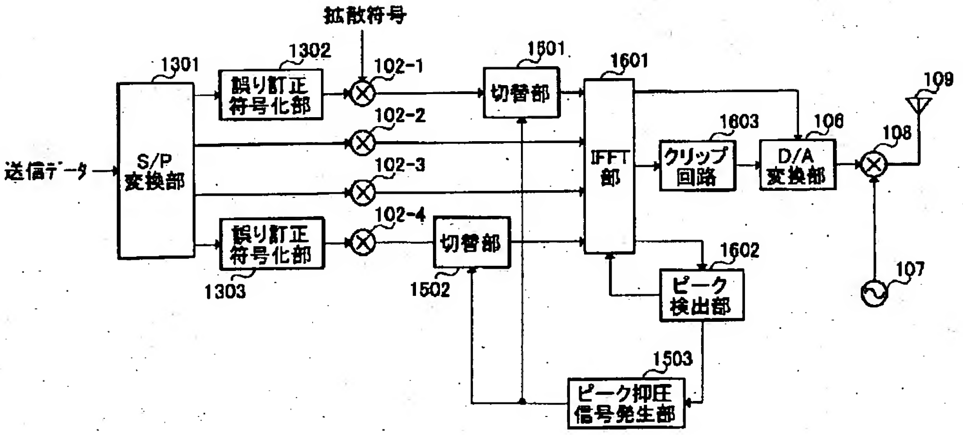
[Drawing 14]


拡散符号
1403
1402
誤り訂正復号化部
206-1
205
201
206-2
204
203
復号データ
P/S変換部
206-3
FFT部
A/D変換部
206-4
誤り訂正復号化部
202
1402

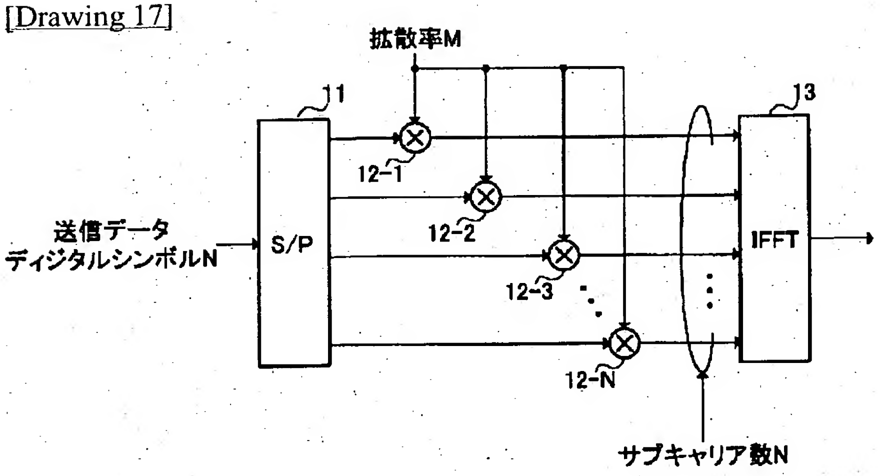
[Drawing 15]


拡散符号
1302
1501
1301
102-1
602
109
誤り訂正符号化部
切替部
102-2
106
108
送信データ
S/P変換部
102-3
IFFT部
D/A変換部
102-4
603
誤り訂正符号化部
切替部
ピーク検出部
107
1303
1502
1503
ピーク抑圧信号発生部

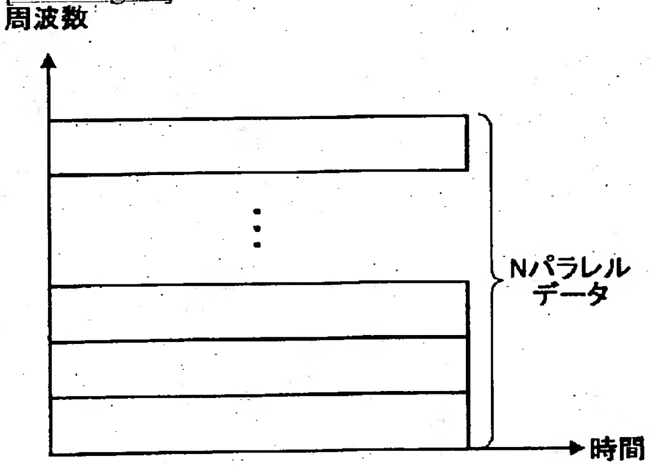
[Drawing 16]


拡散符号
1301
1302
102-1
1501
1601
109
誤り訂正符号化部
切替部
102-2
1603
106
108
送信データ
S/P変換部
IFFT部
クリップ回路
D/A変換部
102-3
102-4
誤り訂正符号化部
切替部
1602
107
1303
1502
ピーク検出部
1503
ピーク抑圧信号発生部

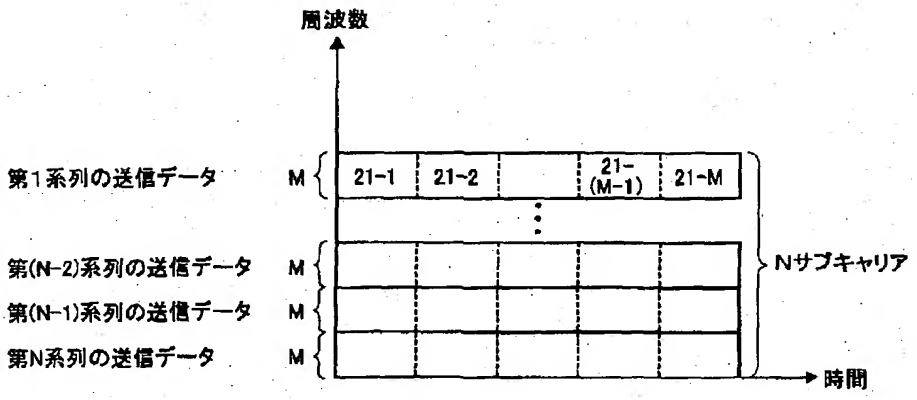
[Drawing 17]


拡散率M
11
13
12-1
12-2
送信データ
ディジタルシンボルN
S/P
IFFT
12-3
12-N
サブキャリア数N

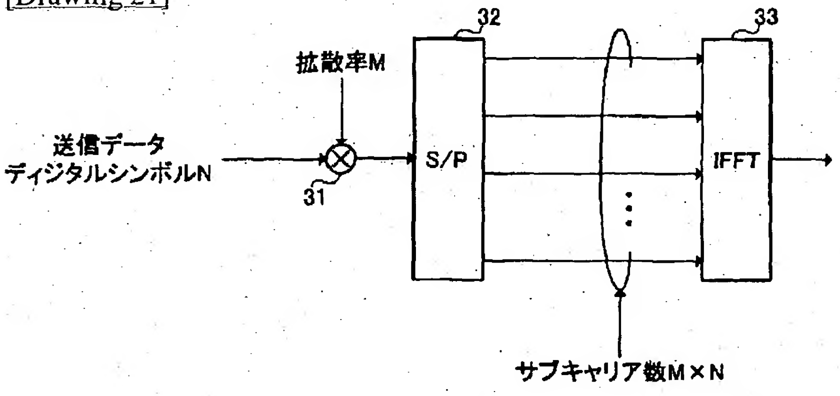
[Drawing 19]


周波数
Nパラレルデータ
時間

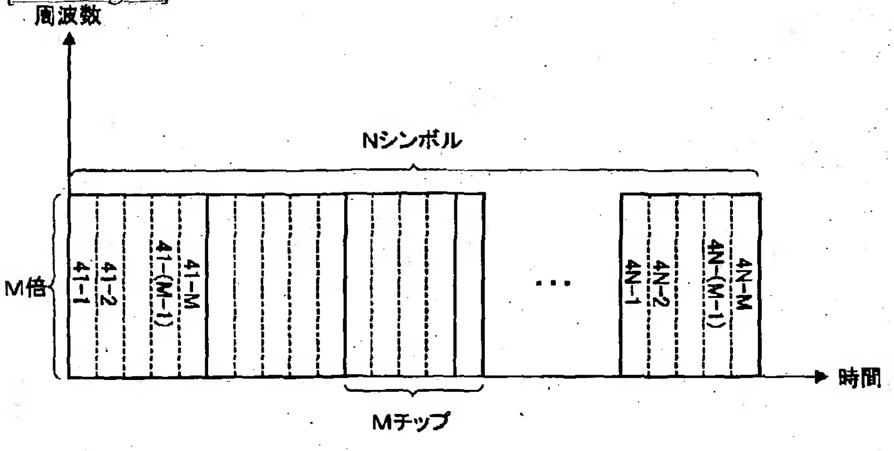
[Drawing 20]


周波数
第1系列の送信データ
M
21-1
21-2
21-(M-1)
21-M
第(N-2)系列の送信データ
M
第(N-1)系列の送信データ
M
第N系列の送信データ
M
Nサブキャリア
時間

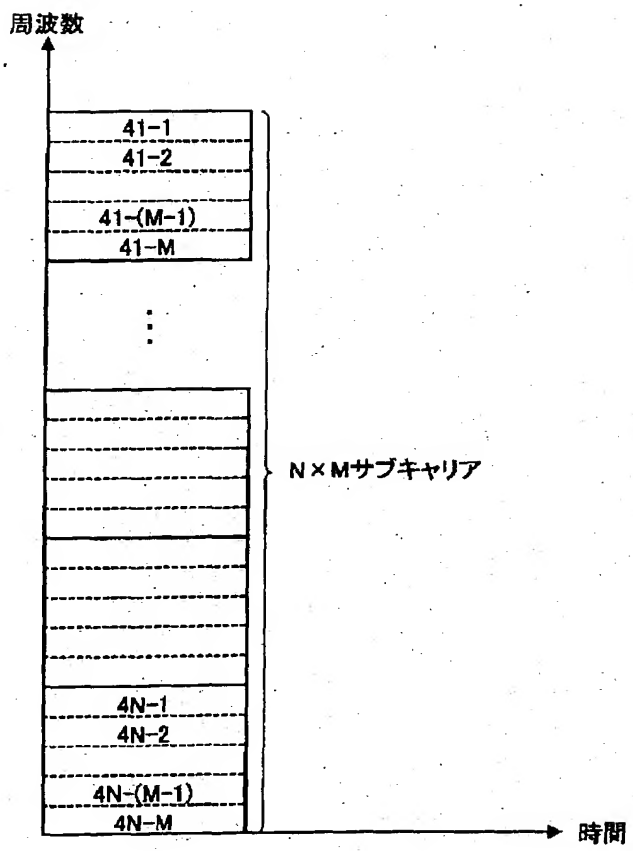
[Drawing 21]


32
33
拡散率M
送信データ
ディジタルシンボルN
31
S/P
IFFT
サブキャリア数M×N

[Drawing 22]


周波数
Nシンボル
M倍
41-1
41-2
41-(M-1)
41-M
4N-1
4N-2
4N-(M-1)
4N-M
時間
Mチップ

[Drawing 23]


周波数
41-1
41-2
41-(M-1)
41-M
4N-1
4N-2
4N-(M-1)
4N-M
N×Mサブキャリア
時間

[Translation done.]